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## ILLINOIS MINERS' AND MECHANICS' INSTITUTES

R. Y. WILLIAMS, DIRECTOR

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### BULLETIN No. I

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## EDUCATION OF MINE EMPLOYEES

BY

H. H. STOEK



PUBLISHED BY THE UNIVERSITY OF ILLINOIS  
URBANA, ILLINOIS



The Illinois Miners' and Mechanics' Institutes were established by Act of the State Legislature, Senate Bill No. 259, approved May 25, 1911. An appropriation of \$15,000.00 per annum to carry out this authorization was included in House Bill No. 895, approved June 30, 1913.

The purpose of the Institutes, as stated in the Act, is "to prevent accidents in mines and other industrial plants and to conserve the resources of the state."

In the development of this purpose, any and all means may be employed which promise "to promote the technical efficiency of all persons working in and about the mines and other industrial plants and to assist them to better overcome the increasing difficulties of mining and other industrial employments."

The administration of the Institutes is vested in the Trustees of the University. The Trustees have appointed a Director and have placed the Institutes under the general supervision of the Department of Mining Engineering of the University of Illinois.

For copies of bulletins, or other information, address the Director, Illinois Miners' and Mechanics' Institutes, Urbana, Illinois.

# **ILLINOIS MINERS' AND MECHANICS' INSTITUTES**

**R. Y. WILLIAMS, DIRECTOR**

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## **BULLETIN No. I**

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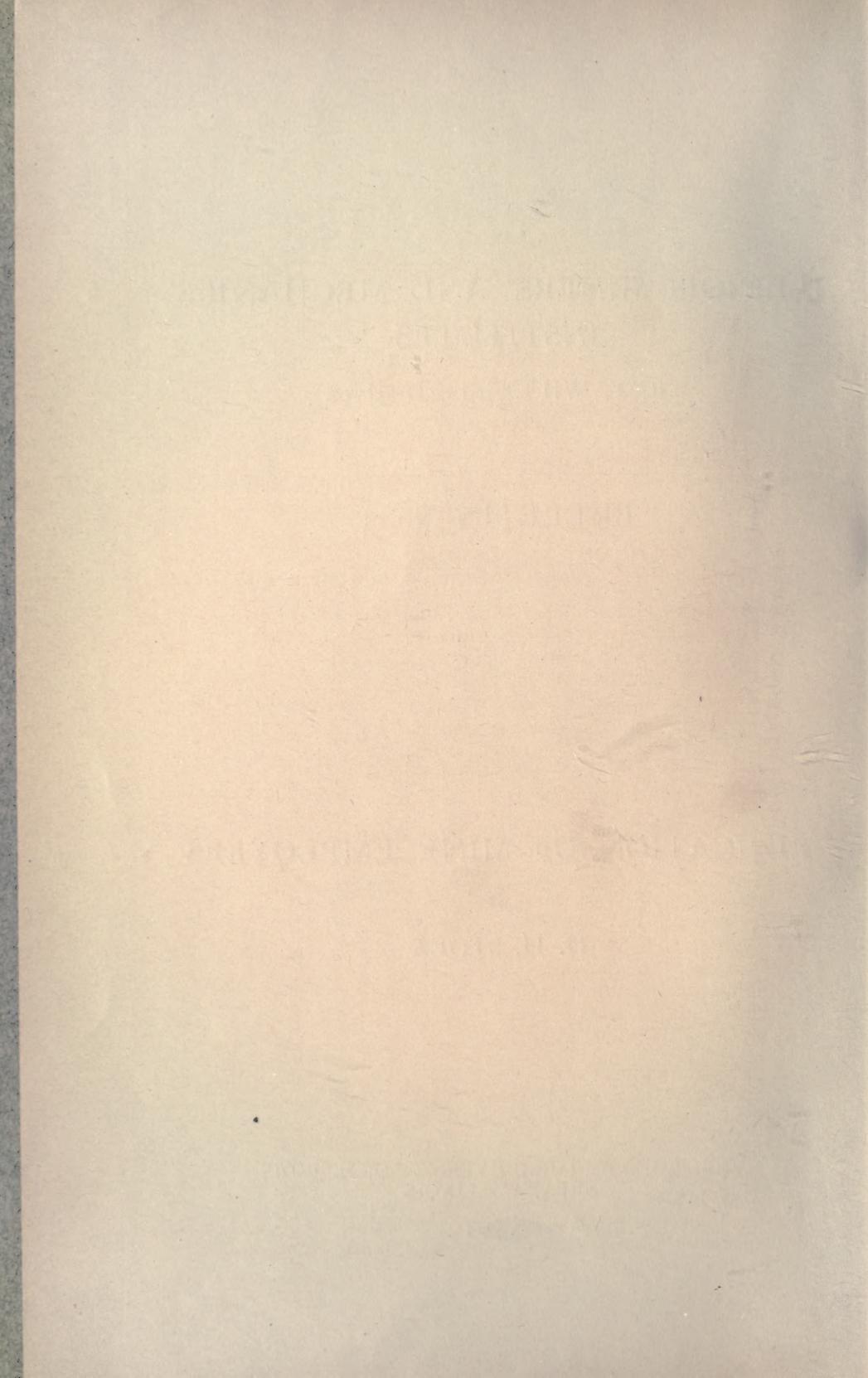
# **EDUCATION OF MINE EMPLOYEES**

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## THE EDUCATION OF MINE EMPLOYEES.

### ILLINOIS MINERS' AND MECHANICS' INSTITUTES.

#### *Authorization for establishment.*

The State of Illinois has by legal enactment set an educational standard in connection with coal mining that is more comprehensive and inclusive than prevails in any other similar industry in the State. Every applicant for a position as mine inspector, mine manager of the first or second class, mine examiner, or hoisting engineer must have a certificate of competency certifying that he has passed a combined written and oral examination given by the State Mining Board. Every miner must have a certificate issued by the Miners' Examining Board and based upon an oral examination to determine his qualifications as a practical miner. Although these educational requirements have been in force for some years, until recently no provision was made by the State for rendering assistance to the men who desired to fit themselves to satisfy the requirements imposed by the State.

At the special session of the Legislature in 1910, called as a result of the Cherry disaster, a bill was passed upon the recommendation of the Mining Investigation Commission establishing the Illinois Miners' and Mechanics' Institutes. The responsibility for the administration of the institutes was placed upon the Trustees of the University of Illinois and an appropriation of \$15,000 was made to carry on the work. The Attorney-General ruled that the Act was unconstitutional, as the subject of it was not mentioned in the Governor's call for the special session of the Legislature.

In 1911 the forty-seventh session of the State Legislature passed an Act which was approved by Governor Charles S. Deneen, May 25, 1911. This Act was essentially the same as the one passed in 1910 in so far as the authorization for establishing institutes was concerned but it carried no appropriation. A separate bill, making an appropriation of \$15,000 for carrying on the work, passed the Senate and two readings in the House but failed of final passage; consequently it was impossible to begin the work as there were no other funds available for the purpose. The forty-eighth session of the State Legislature in 1913 in the bill providing for the general expenses of the State Government, appropriated \$15,000 per annum to the Trustees of the University of Illinois for the Miners' and Mechanics' Institutes. With

such appropriation and under the Act of 1911 authorizing the institutes the Board of Trustees of the University of Illinois authorized the Department of Mining Engineering of the University to proceed with the work and on January 1, 1914, R. Y. Williams was appointed as Director of the Miners' and Mechanics' Institutes.

The act of authorization is as follows:

### ILLINOIS MINERS' AND MECHANICS' INSTITUTES.

(Senate Bill No. 259, Approved May 25, 1911.)

*AN ACT to prevent accidents in mines and other industrial plants and to conserve the resources of the State by the establishment of Illinois Miners' and Mechanics' Institutes and for the administration and support of the same.*

**SECTION 1.** *Be it enacted by the People of the State of Illinois represented in the General Assembly:* That in order to prevent accidents in mines and other industrial plants and to conserve the resources of the State, by the education and training of all classes of workers in and about the mines and other industrial plants of the State, there shall be established and maintained a form of educational betterment work, which shall be known as the Illinois Miners' and Mechanics' Institutes.

§ 2. That it shall be the purpose of such Illinois Miners' and Mechanics' Institutes to promote the technical efficiency of all persons working in and about the mines and other industrial plants of the State and to assist them to better overcome the increasing difficulties of mining and other industrial employments. In the development of this purpose, any and all means may be employed which promise to give desired results such as bulletins, traveling libraries, lectures, correspondence work, classes for systematic instruction, or meetings for the reading and discussion of papers.

§ 3. That the administration of the Illinois Miners' and Mechanics' Institutes, as provided in section 1 hereof, shall vest in the trustees of the University of Illinois; that all money appropriated by the State for the purpose of this Act shall be made available to said trustees; and that the said trustees be and hereby are authorized and directed to proceed with the work of the organization, maintenance and administration through their regularly authorized agents, aided by such other persons as in their judgment the work may require.

§ 4. The State Board of Contracts is hereby authorized and directed to provide all necessary printing for the Illinois Miners' and Mechanics' Institute, including such bulletins as may be published from time to time by the Illinois Miners' and Mechanics' Institutes.

APPROVED May 25, 1911.

The *purpose* of such institutes is defined by the act of incorporation to be:

"To promote the technical efficiency of all persons working in and about the mines and other industrial plants of the state and to assist them to better overcome the increasing difficulties of mining and other industrial establishment."

To attain this purpose:

"All means may be employed which promise to give desired results, such as bulletins, traveling libraries, lectures, correspondence work, classes for systematic instruction, or meetings for the reading and discussion of papers."

The purpose of the Miners' and Mechanics' Institutes may be considered under the three following heads:

1. The general dissemination of any information that pertains to the mining industry and that will make for its betterment from the standpoint of safety, economy and efficiency for the miner, the operator and the general public.

2. The specific training and assistance of men:

- (a) To pass the state examination for inspector, manager, etc.
- (b) To secure a miner's certificate.

3. The teaching of the elementary principles of mining, and incidentally the English language, to the foreign non-English-speaking men who make up a large proportion of the present mining population.

Most of the methods of carrying on work, as authorized, have been tried in the United States, British America, and European countries. All have been successful under certain conditions, some have proven impracticable under other conditions. Hence, before the methods best adapted to the conditions of the mining industry in Illinois can be determined it will be necessary to try out in the State a number of those that have been found satisfactory elsewhere.

The conditions in Illinois are very different, for instance, from those that prevail in the anthracite region of Pennsylvania, where a very successful institute movement has been carried on for a number of years under particularly favorable conditions, for there is a dense mining population in and about large cities, making it possible and comparatively easy for large numbers of mining men to assemble for meetings. The entire area of the anthracite region is less than 500 square miles and only a small part of that area, owing to topographical reasons, is populated by the more than 150,000 employees

engaged in the anthracite industry. In Illinois, on the other hand, about 80,000 employees are scattered over an area of 36,800 square miles, and there are very few districts where large numbers of the mine employees can get together easily. Consequently, the difficulty and cost of reaching a thousand men in Illinois for instructional purposes will of necessity be much greater than in a thickly settled district, such as the anthracite region, or in European countries. Also the time required to establish a comprehensive movement throughout the coal regions of Illinois must be correspondingly greater than in thickly populated regions and will depend largely upon the money available for carrying on the work.

The amount appropriated, \$15,000, probably will not permit of putting into force at once a comprehensive scheme covering the entire state even if the method best adapted to Illinois conditions had been demonstrated.

In presenting the suggestion of Miners' Institutes to the appropriations committee of the State Legislature, various methods of carrying on the work were given as follows:

Cooperation with :

1. School Boards along lines for which assistance had been asked.
2. Illinois Mine Rescue Commission.
3. Libraries through placing of mining books in mining centers.
4. Short courses.
  - (a) In mining centers.
  - (b) At University of Illinois.
5. Local mining institutes for the reading and discussion of papers and the hearing of lectures.
6. Local short courses in connection with and in addition to local institutes.
7. Educational Bulletins.
8. Special lectures for miners who do not speak English.

As one step in the establishment of the Institutes the present bulletin aims to give a brief account of the ways and methods used in carrying on similar work elsewhere. The data have been gathered by correspondence, by a personal inspection of a number of the projects described, and from the literature on the subject.

The writer is indebted to the State Mining Departments, the managers and engineers of mining companies, to the authorities of the Young Men's Christian Association in Pennsylvania and West Virginia, where mining institutes have been very efficiently carried on un-

der the direction of the Y. M. C. A., to the teachers of mining in a number of Institutions, and especially to Professor F. R. Sexton, Director of Technical Education in Nova Scotia for detailed information regarding the very successful miners' schools carried on by him in Nova Scotia, and for permission to use portions of the Report of the Canadian Royal Commission on Industrial Training and Technical Education from which data have been obtained in regard to the schools of Canada and Europe. Also to Miss Margaret Hutchins, Reference Assistant, University of Illinois Library, for the comprehensive bibliography appended to the bulletin. Definite credit has been given to the original sources of information where possible to do so.

## NECESSITY FOR INDUSTRIAL EDUCATION.

One of the most important and prominent topics under consideration by the industrial and educational world at the present time is what is known as industrial education, that is, such education and training as will produce more skilled workmen and better foremen and bosses. The necessity for such training is not confined to one industry, to one locality, or to one nationality of workmen, but is very generally felt in all industrial enterprises.

The operation and supervision of a mine is very different from that of a factory. In a mine the men work in small groups, frequently not more than two in a place and apart from the other workers, so that it is impossible to have the close supervision that obtains in a factory or shop, where a foreman can see a large number of men at one time. Hence all the employees about mines should be so trained that they may not jeopardize their own lives and the lives of their fellow-workers, and that the coal or other mineral may be efficiently mined.

In connection with the coal mining industry there are three urgent reasons for this kind of education, namely:

First: The rapid development of the industry.

Second: The change in character of the mining population.

Third: The educational requirements that have been imposed upon the employees about the coal mines by legislative enactments.

### THE RAPID DEVELOPMENT OF THE COAL MINING INDUSTRY.

The total value of the mineral output of the United States in 1912 was \$2,243,630,326, and for the same year the coal output was valued at \$695,606,071, an increase of \$69,040,860 over 1911. The gain in the value of the bituminous coal output was \$68,000,000. The mineral production of Illinois during 1912 was \$123,068,867, of which coal represented \$70,294,338.

The development of the coal industry in Illinois is shown by the following table of output and employees as taken from the reports on the Production of bituminous coal, by E. W. Parker, Statistician, United States Geological Survey:

TABLE I.

PRODUCTION OF BITUMINOUS COAL IN UNITED STATES AND IN ILLINOIS AND  
EMPLOYEES IN ILLINOIS COAL MINES, 1840-1912

Year	Production in United States (short tons)	Production in Illinois (short tons)	Percent of total production	Illinois Employees
1840	1,102,931	16,967	1.5	
1850	2,880,017	300,000	10.4	
1860	6,494,200	728,400	11.2	
1870	17,371,305	2,624,163	15.1	6,301
1880	42,831,758	6,115,377	14.3	16,301
1890	111,302,322	15,292,420	13.7	30,076 (1889)
1900	212,316,112	25,767,981	12.1	36,130 (1899)
1910	417,111,142	45,900,246	11.0	72,645
1912	450,104,982	59,885,226	13.3	78,098

Although the coal output of Illinois is constantly increasing, the number of mines is steadily decreasing, showing that the mines are becoming each year of greater extent. The science of coal mining has likewise advanced greatly, deeper mines have been opened, and machinery has replaced hand labor in many places. These improvements in mechanical and electrical appliances in and about the mines have greatly increased the complexity of the equipment and made necessary greater technical knowledge to operate the mines.

#### THE CHANGE IN CHARACTER OF THE MINING POPULATION

About the coal mines of the United States the nationality of the mining population has changed greatly during the past 40 years. Formerly the coal miners were English-speaking and were either American by birth or had come to the United States directly from England, Scotland, Wales, Ireland or Germany, where they and their forefathers had been engaged in mining. At present the bulk of the mining is being done by men from southeastern Europe, often called Slavs, but under this term is included Huns, Poles, Italians, Greeks and Lithuanians. These men were mainly agriculturists in Europe, and though many of them had no knowledge of mining prior to coming to America, they are frequently put into the mines soon after landing without preliminary training, and too often before they can speak or understand the English language.

In 1907 the National Congress provided for the appointment of a Commission, consisting of three senators, three members of the House of Representatives and three persons appointed by the President of the United States with authority to investigate fully the subject of immigration. Under date of June 15, 1910, the Commission presented its first report and several of the volumes included in this report have a direct bearing upon the condition of the coal mine employees of the

United States. The following data for the racial distribution and the literacy of the mine workers in the Middle West are based upon this report.\*

Racial movements to the coal fields of the Middle West correspond to the general periods during which representative races of immigrants have come to the United States since 1870, as well as to the periods of most rapid extension of coal-mining operations. In general, it may be said that the pioneer coal-mining operatives in this territory were Americans, English, Irish, Scotch, Welsh, Germans, and a few French and English Canadians, and Scandinavians. There are no available statistics of nationalities employed prior to 1890, but prior to that date there were very few representatives of immigrant races, excepting those from Great Britain and Germany.

The racial distribution of miners in Illinois according to the Census of 1890 is shown in Table 2. This table shows that less than ten per cent of the mining population were then immigrants from southeastern Europe.

TABLE 2.  
RACIAL DISTRIBUTION OF MINERS IN ILLINOIS IN 1890.

Nativity	Number	Per Cent.
Native White		
Native parents .....	4,744	
Foreign parents .....	4,175	
Total Native White.....	8,919	
Foreign White .....	12,720	
Total Colored .....	556	
Grand Total .....	22,195	63.6
Foreign Born by Country of Birth		
Canada (English) .....	78	
Canada (French) .....	7	
Germany .....	2,777	
Great Britain .....	4,837	
Ireland .....	1,136	
Sweden, Norway, Denmark.....	700	
Total Canada and Northern Europe.....	9,535	27.3
Other Countries .....	3,185	9.1
Total Foreign Born.....	12,720	36.4

During the decade 1890 to 1900 there was a change in the racial composition of the mine workers in Illinois due to the development of

\*Report of the United States Immigration Commission, Vols. 6 and 7. Bituminous Coal Mining. Vol. 20. Summary on Manufacturing and Mining.

two additional sources of labor supply: (1) An influx of mine workers from other coal fields of the United States; (2) the arrival of immigrants from southern and eastern Europe. The migration from other fields in this country was made up principally of the English, Irish, Scotch, Welsh, and Germans, who left the mines of Pennsylvania and other eastern mining states because of labor disputes and the pressure of races of more recent immigration who were entering the industry in those states. The European races which at the time were securing employment in the middle west were north and south Italians, Lithuanians, Poles, Russians, French and French-Belgians, and a few Magyars.

Americans and immigrants from northern Europe and Great Britain constituted about four-fifths of the total number of mine workers in 1899, Table 3, while the remaining one-fifth was composed of the more recent arrivals from southern and eastern Europe.

TABLE 3

## COAL-MINE EMPLOYEES IN ILLINOIS, BY NATIONALITY, IN 1899

(Compiled from Illinois Report for 1899. This table does not include 861 employees whose nationality was not reported.)

Race	Number	Percent
American .....	15,580	43.12
English .....	3,394	9.40
Scotch .....	1,412	3.91
Irish .....	2,086	5.77
Welsh .....	645	1.79
German .....	4,138	11.45
French .....	373	1.03
Belgian .....	487	1.35
Scandinavian .....	619	1.71
American and N. W. Europe.....	28,734	79.53
Italian .....	3,016	8.35
Austrian and Bohemian.....	975	2.70
Hungarian .....	774	2.14
Polish .....	2,133	5.90
Russian .....	498	1.38
Southern and South-Eastern Europe.....	7,396	20.47
Total .....	36,130	100.00

After the year 1900, the movement of immigrant races of southern and eastern Europe into the middle west steadily continued, and was especially marked during the period 1902 to 1907, on account of the extraordinary development and the opening of new mining districts. During this period a movement of the races of older immigration out of the mines of the middle west to other mining localities, especially those of Kansas and Oklahoma, under the pressure of the recent arrivals, was also noticeable. In 1910 it was estimated that slightly more than one-half of the total number of employees in the coal mines

of Ohio, Indiana and Illinois were of foreign birth, and that almost three-fourths of those foreign-born belonged to races of southern and eastern Europe.

The situation at present, therefore, as regards the racial classification of mining employees, is in strong contrast to that prior to 1900, and it is evident that since that year there has been a constant and increasing influx of races from southern and eastern Europe into the mines of Illinois.

This change in population is strikingly shown by considering the distinctively coal mining towns of the state under two heads.

First: Towns that have come into existence during the past ten years as a result of the opening of new mines are populated almost entirely by an influx of races of recent immigration.

Second: In old towns that have steadily or suddenly increased in population because of an expansion of coal mining operations the additions have been almost entirely of recently arrived immigrants from southern Europe.

No general tables for racial distribution for all employees in Illinois are available at present, but out of a total of 18,737 coal mine employees in the middle west studied by the Immigration Commission the relative number and percentage of each race are shown in Table 4.

TABLE 4.

DISTRIBUTION IN 1910 OF MALE EMPLOYEES IN THE COAL MINES OF THE MIDDLE WEST, BY GENERAL NATIVITY AND RACE, BASED ON A STUDY OF 18,737 EMPLOYEES

General Nativity and Race	No.	Per Cent.
Native-born of native father:		
White .....	6,003	32.0
Negro .....	584	3.1
Native-born of foreign father, by country of birth of father:		
Australia .....	1	(a)
Austria-Hungary .....	174	.9
Belgium .....	10	.1
Canada .....	18	.1
Denmark .....	5	(a)
England .....	590	3.1
France .....	67	.4
Germany .....	883	4.7
Ireland .....	322	1.7
Italy .....	56	.3
Netherlands .....	2	(a)
Norway .....	4	(a)
Russia .....	57	.3
Scotland .....	286	1.5
Sweden .....	20	.1
Switzerland .....	10	.1
Wales .....	212	1.1

Foreign-born, by race:	No.	Per Cent.
Bohemian and Moravian.....	253	1.4
Bulgarian .....	17	.1
Canadian, French .....	11	.1
Canadian, Other .....	8	(a)
Croatian .....	183	1.0
Danish .....	7	(a)
Dutch .....	22	.1
English .....	812	4.3
Finnish .....	29	.2
French .....	194	1.0
German .....	864	4.6
Greek .....	12	.1
Hebrew (other than Russian).....	2	(a)
Irish .....	128	0.7
Italian, North .....	1,716	9.2
Italian, South .....	422	2.3
Italian (not specified).....	4	(a)
Lithuanian .....	1,086	5.8
Magyar .....	648	3.5
Mexican .....	1	(a)
Montenegrin .....	33	.2
Norwegian .....	7	(a)
Polish .....	823	4.4
Roumanian .....	11	.1
Russian .....	377	2.0
Ruthenian .....	20	.1
Scotch .....	350	1.9
Scotch-Irish .....	1	(a)
Servian .....	24	.1
Slovak .....	796	4.2
Slovenian .....	99	.5
Swedish .....	67	.4
Syrian .....	8	(a)
Welsh .....	160	.9
Australian (race not specified).....	1	(a)
Austrian (race not specified).....	127	.7
Belgian (race not specified).....	102	.5
Swiss (race not specified).....	8	(a)
Grand Total .....	18,737	100.0
Total native-born of foreign father.....	2,717	14.5
Total native-born .....	9,304	49.7
Total foreign-born .....	9,433	50.3
(a) Less than 0.05 per cent.		

The total number of second generation immigrants at work in the mines is about 14 per cent of the total number of employees, making, with the persons native-born of foreign father, a proportion equal to about one-half of the total number of persons employed.

#### *Length of Residence of Immigrants.*

Table 5 shows the length of residence of foreign born male employees based upon a study of 9331 residents in the coal fields of the middle west.

TABLE 5.

## PER CENT. OF FOREIGN-BORN MALE EMPLOYEES IN THE UNITED STATES EACH SPECIFIED NUMBER OF YEARS, BY RACE.

(By years in the United States is meant years since first arrival in the United States. No deduction is made for time spent abroad. This table includes only races with 40 or more males reporting. The total,\* however, is for all foreign-born).

Race	No. reporting complete data	Per cent in the United States each specified number of years.				
		Under 5	5 to 9	10 to 14	15 to 19	20 or over
Bohemian and Moravian	252	35.7	28.2	3.2	11.5	21.4
English	796	25.5	12.1	1.3	2.8	58.4
French	192	22.4	35.4	6.3	11.5	24.5
German	856	17.1	12.4	3.0	17.6	49.9
Irish	125	9.6	8.0	2.4	4.8	75.2
Scotch	340	19.4	12.7	1.7	6.6	59.5
Swedish	67	7.5	13.4	4.5	14.9	59.7
Welsh	150	6.9	2.5	3.1	5.0	82.4
Croatian	181	21.5	49.7	15.5	8.8	4.4
Italian, North	1,699	29.1	40.4	10.4	11.6	8.5
Italian, South	419	34.4	49.2	8.8	3.3	4.3
Lithuanian	1,086	21.9	39.2	18.8	14.7	5.3
Magyar	632	39.7	38.6	7.4	8.7	5.5
Polish	810	30.6	37.7	10.6	11.4	9.8
Russian	372	32.8	34.9	12.9	13.2	6.2
Slovak	793	18.0	27.4	14.0	15.8	24.8
Slovenian	96	31.3	40.6	8.3	10.4	9.4
*Total	9,331	26.0	31.1	9.1	11.1	22.6

Upon examining the total for all races in table 5 it is seen that 57.1% have been in this country less than ten years and 26% less than five years. On the other hand, 22.6% have been in the United States more than twenty years and 20.2% between ten and twenty years. Those who have been in this country more than twenty years include races from Great Britain and northern Europe, and of the races of southern and eastern Europe, only the Slovak shows any important proportion which has been in the country a considerable number of years, more than 50% of the Slovaks reporting a residence longer than ten years, and 24.8% a residence longer than twenty years. Almost 60% each of the Scotch, Swedes, and English, 75.2% of the Irish, 82.4% of the Welsh and 49.9% of the Germans employed in the middle west have been in the United States more than twenty years. A considerable number of English, German, and Scotch immigrants are still entering the mines of this field, but very few Irish and Welsh, as evidenced by the proportions of these races which have a period of residence of less than five years. This is partly to be explained by the fact that the English, German, and Scotch immigrants are coming to

the fields of the middle west from other mining sections of the United States as well as from abroad. The small number of recent Welsh arrivals is due to the comparatively small proportion of immigrants of this race. The lack of any considerable number of Irish of recent arrival arises from the falling off of the immigrants of this race as well as from the fact that the Irish of older immigration are leaving the coal-mining industry, and the Irish of recent arrival are finding work outside the bituminous coal-mining industry. On the other hand those who have a period of residence of less than five years include principally southern and eastern European races, which obviously indicates that the new employees in the industry are being secured from these sources.

The races which have been coming to the fields of the middle west in greatest numbers during recent years are the Croation, North and South Italian, Lithuanian, Magyar, Polish, Russian, and Slovenian. Of the Croatians, 71.2% have been in the United States less than ten years and 21.5% under five years, as compared with 28.7% who have been in the country more than ten years. Of the North Italian employees 29.1% have been in the country less than five years and about 70% less than ten years. A greater proportion of the Southern Italians than the North Italians have been in the country less than five years, and more than 80% of the race have a residence less than ten years. In the coal communities of the middle west 61.1% of the Lithuanians, 78.3% of the Magyars, 68.3% of the Poles, 67.7% of the Russians, and 71.9% of the Slovenians have been in the United States less than ten years. This showing becomes even more striking when in the same connection it is also noticed that more than 30% of the Slovenians, Russians, Poles, and South Italians, almost 30% of North Italians and about 40% of the Magyars have been in the country less than five years. Considerable numbers of the same races have a period of residence of less than one year. In this connection it is interesting to note that of 2426 who have been in the United States less than five years, 154 have been here less than one year and 593 two years only. Consequently the inference is plain that immigrants, the greater numbers of whom have no experience or training abroad in mining, are employed in the industry in the middle west immediately after their arrival in this country.

#### *Knowledge of the English Language.*

An element of danger to those working in the mines is the fact that many of the recent immigrants do not speak or understand English with any degree of fluency and almost none are able to read

or write the language. Because of these facts it is probable that the instructions of those in authority are frequently misunderstood. A mine manager, for example, tells an immigrant miner, in English of course, that his roof needs propping. The miner seems to understand, but does not, and in consequence a fall of top may result in injury to the miner. Printed signs used to indicate the presence of gas or other peril, are unintelligible to many of the foreigners.

Table 6 gives data for the ability to speak English of 7761 individuals divided into three groups. First, those who have been in the United States less than five years; 2nd, those who have been here five to ten years; and, 3rd, those who have been here more than ten years.

TABLE 6.

PER CENT OF FOREIGN-BORN MALE EMPLOYEES WHO SPEAK ENGLISH, BY YEARS IN THE UNITED STATES AND RACE.

(By years in the United States is meant years since first arrival in the United States. This table includes only non-English-speaking races with 100 or more persons reporting. The total,\* however, is for all non-English-speaking races.)

Race	No. Report- ing Complete	Per Cent. who speak English, by years in United States.			
		Data.	Under 5	5-9	10 or over
Bohemian and Moravian	247	58.0	76.8	96.7	77.3
French	190	30.2	68.2	88.9	68.4
German	841	56.3	86.3	98.0	89.4
Croatian	180	57.9	82.2	88.5	78.9
Italian, North	1,685	41.2	72.2	88.1	68.0
Italian, South	416	32.9	51.0	84.1	50.2
Lithuanian	1,080	50.6	78.0	88.1	75.9
Magyar	596	26.5	57.3	79.2	50.0
Polish	787	29.7	63.4	76.3	57.3
Russian	371	35.2	77.5	90.8	67.9
Slovak	778	44.5	72.3	83.4	73.5
*Total	7,761	40.9	71.0	88.7	69.7

The total shows that 40.9 per cent of all the individuals included in the first group, 71 per cent of all those included in the second group, and 88.7 per cent of all those included in the third group can speak English, indicating a decided progression from group to group in the ability to speak English.

The races having the largest proportions of individuals able to speak English are, for the first group, the Bohemian and Moravian, Croatian, and German; for the second group, the German, Croatian, Lithuanian, and Russian; and for the third group, the German, Bohemian and Moravian, Russian, and French. The races for which the smallest proportions of individuals who can speak English are reported are, in the first group, the Magyar and Pole; in the second group, the

South Italian and Magyar; and in the third group, the Magyar and Pole.

Table 7 gives data for the literacy of 18,333 mine workers in the middle west, by nativity and race the test of literacy being the ability to read or to read and write any language. The percentages are for the principal races, and the totals are for all races.

TABLE 7.

PERCENT OF MALE EMPLOYEES WHO READ AND PERCENT WHO READ AND WRITE,  
BY GENERAL NATIVITY AND RACE.

(This table includes only races with 40 or more males reporting. The totals,\* however, are for all races.)

Nativity and Race	Number reporting complete data	Percent who— Read	Percent who— Read & Write
<b>Native-born of native father:</b>			
White .....	5,833	97.4	96.7
Negro .....	566	91.1	88.5
<b>Native-born of foreign father, by country of birth of father:</b>			
England .....	581	99.1	99.0
France .....	67	100.0	100.0
Germany .....	848	99.4	99.1
Ireland .....	318	98.4	98.1
Scotland .....	279	99.6	99.6
Wales .....	208	98.1	97.6
Austria-Hungary .....	172	98.8	98.3
Italy .....	53	96.2	96.2
Russia .....	56	100.0	100.0
<b>Foreign birth by race:</b>			
Bohemian and Moravian.....	249	97.6	96.4
English .....	803	98.1	97.9
French .....	190	99.5	88.9
German .....	849	98.6	98.0
Irish .....	126	92.9	91.3
Scotch .....	346	99.1	98.6
Swedish .....	67	100.0	97.0
Welsh .....	160	95.6	93.1
Italian, North .....	1,700	93.0	92.0
Italian, South .....	417	63.0	57.3
Lithuanian .....	1,081	80.4	75.2
Magyar .....	617	93.8	92.5
Polish .....	798	76.3	72.1
Russian .....	373	73.7	70.8
Slovak .....	784	86.0	80.7
Slovenian .....	96	81.3	81.3
*Grand Total .....	18,333	92.6	91.0
Total native-born of foreign father .....	2,649	99.1	98.8
Total native-born .....	9,048	97.5	96.8
Total foreign-born .....	9,285	87.8	85.4

A slightly greater degree of illiteracy is indicated by those whose fathers were born in Wales than by the other employees whose fathers were born in Great Britain. Among persons native-born of foreign father, it is worthy of note that all of the employees whose fathers were born in Russia or France can both read and write. Of the employees whose fathers were born in Austria-Hungary between 1 and 2 per cent can not read or write, while more than 3 per cent of those whose fathers were born in Italy are illiterate.

As regards the races of foreign birth, about 2 per cent of the English, Scotch, and Germans are unable to read or write, and from 7 to 8 per cent of the Irish and 4 to 6 per cent of the Welsh are illiterate. Of the employees of the French race, 9.5 per cent can not read and 11.1 per cent can neither read nor write. The Bohemian and Moravian mine workers indicate a relatively higher degree of literacy as compared with other races of southern and eastern Europe, 96.4 per cent being able both to read and write. At the other extreme, the South Italian shows only 57.3 per cent able both to read and write. Of the Lithuanians 80.4 per cent can read and 75.2 per cent can both read and write, while 76.3 per cent of the Poles can read and 72.1 per cent can both read and write.

#### *Inexperience of Immigrants from Southeastern Europe.*

Men of the races of the old immigration, those from northwestern Europe, have been employed in the mines of the United States for many years. As a result of their experience both in this country and abroad, they are far better qualified as miners than are the southern and eastern Europeans. The older immigrants speak English either as their native tongue or, as in the case of the Germans and Scandinavians, because of long residence in this country. They may be treated in almost every respect upon the same basis as the American miners.

The employees of the races of the recent immigration, on the other hand, have been in the United States for so short a period of time that even though it be assumed that they have been employed in mining ever since their arrival, they must have had but a brief experience in the mines of this country. The data further show that a very few of their number had mining experience abroad.

The lack of previous mining training by the immigrants from southeastern Europe is strikingly shown by Table 8.

TABLE 8.

PER CENT OF FOREIGN-BORN MALE EMPLOYEES IN EACH SPECIFIED OCCUPATION BEFORE COMING TO THE UNITED STATES, BY RACE.

(This table includes only races with 80 or more males reporting. The total,\* however, is for all foreign-born.)

Race	Number Reporting Complete		Farm- ing or Farm				Hand Trades	Other Occupations
	Data	Mining	Labor	Gen. Labor	Mfg.			
Bohemian & Moravian....	196	72.4	10.7	5.6	1.0	8.7	1.5	
English .....	547	87.8	1.5	2.0	1.3	3.1	4.4	
German .....	575	59.7	17.6	5.4	1.9	9.9	5.6	
Scotch .....	237	92.4	1.3	3.0	.0	.4	3.0	
Welsh .....	92	91.3	1.1	3.3	.0	.0	4.3	
Croatian .....	155	7.1	81.3	4.5	3.2	1.3	2.6	
Italian, North .....	1,551	22.8	52.0	5.9	4.1	9.0	6.2	
Italian, South .....	361	23.3	62.6	6.6	.0	5.5	1.9	
Lithuanian .....	1,023	3.6	79.7	9.7	1.6	4.5	1.0	
Magyar .....	581	17.7	69.7	3.1	1.4	6.4	1.7	
Polish .....	741	14.2	70.9	4.2	2.0	6.3	2.4	
Russian .....	344	7.3	86.9	.9	.3	3.8	.9	
Slovak .....	684	15.1	75.3	2.3	1.9	3.9	1.5	
Slovenian .....	86	34.8	45.3	4.7	1.2	12.8	1.2	
*Total .....	7,676	30.5	53.2	5.0	2.0	6.1	3.2	

The preceding table shows that only 30.5 per cent of the total number reporting were miners abroad, the greater part, 53.2 per cent, having been farmers or farm laborers. By a separation of the older from the more recent immigrants it appears that those from southern and eastern Europe, which constitute the principal source of mining labor at present, report only 13.8 per cent as having had any experience or training in mining abroad. Five per cent of the total number reporting were employed as common laborers prior to their arrival in the United States; 6.1 per cent were in hand trades; 2 per cent were in manufacturing industries; and 3.2 per cent had occupations not specified. The two principal groups, farming and mining, comprise upward of four-fifths of the immigrants from each of the leading races.

As regards the proportions of the different races, the Scotch exhibit 92.4 per cent, the Welsh 91.3 per cent, the English 87.8 per cent, the Bohemian and Moravian 72.4 per cent, and the German 59.7 per cent, engaged in the mining industry before coming to this country. Only 22.8 per cent of the North Italians, 23.3 per cent of the South Italians, 17.7 per cent of the Magyars, 15.1 per cent of the Slovaks, and 14.2 per cent of the Poles were miners prior to their immigration to the United States. The Lithuanians with 3.6 per cent, Croatians with 7.1 per cent, and Russians with 7.3 per cent, show the smallest

percentage of persons with previous experience in the work in which they are now engaged in this country.

Practically all of the foreign-born employees in the mines of the middle west who come to the mining regions directly from abroad enter the mines as loaders after the machines, or in some other unskilled occupation. The immediate employment of the untrained immigrant in the mines is made possible by the use of machine methods. A considerable number of employees of foreign birth who are found in the mines of the middle west have had experience in mining in Pennsylvania, West Virginia, or other mining localities. These persons are able to secure positions as hand or pick miners, or to enter some day or shift occupations, such as cagers, timbermen, and track layers. The great majority of immigrants from Great Britain have had a knowledge of mining before coming to this country or to the middle west, and are, consequently, able to take up occupations requiring experience and training and calling for the exercise of intelligent judgment.

Races of recent immigration are still in a large measure restricted to the occupation of diggers and loaders, in which they began work, partly because the work in these occupations can be made to yield a larger income than the average return to be had from other mining occupations, and partly because their lack of knowledge of English and their unfamiliarity with American customs and institutions render the immigrants less adaptable to the mining occupations in general than natives and English-speaking peoples. This general tendency, however, is by no means without exception. The Slovaks, North Italians, French Belgians, Tyrolese, and Lithuanians are manifesting a disposition to distribute themselves throughout all but the more responsible of the mining occupations and are not uncommonly found at such work as caging, timbering, tracklaying, and machine mining. Natives and English-speaking peoples have control in a large measure of the more responsible positions in the mines, as those of superintendents, and are also found generally distributed throughout all the mining occupations.

#### EDUCATIONAL REQUIREMENTS FOR MINE EMPLOYEES.

In 1870 the Legislature of Pennsylvania passed the first general mining law for the anthracite mines of Pennsylvania, which law provided for the appointment of mine inspectors based upon a state examination. In 1885 the Legislature of Pennsylvania provided that mine foremen, assistant mine foremen and fire bosses should pass an examination before being granted certificates of competency. Other states

have since passed similar legislation and now most of the states of importance in the United States as coal producers, the Canadian Provinces and the countries of Europe producing coal, require an educational test in the form of an examination before a person can secure a certificate that will permit him to work about the mines in a position of authority; in some States and Provinces every miner must be examined to test his competency before he is permitted to mine coal.

The importance of these state examinations in America and the growth of sentiment in the several states in favor of such technical qualifications for mining positions are shown by Tables 9, 10 and 11.

TABLE 9.

NUMBER OF PERSONS TAKING EXAMINATIONS FOR STATE CERTIFICATES OF COMPETENCY IN 1905 AND 1906.

STATE	1905					1906				
	Mine Inspector.	Mine Foreman or Manager, 1st Class.	Mine Foreman or Manager, 2d Class.	Fire Boss or Mine Examiner.	Hoisting Engineer.	Mine Inspector.	Mine Foreman or Manager, 1st Class.	Mine Foreman or Manager, 2d Class.	Fire Boss or Mine Examiner.	Hoisting Engineer.
Alabama .....	.....	33	.....	19	.....	.....	39	.....	34	.....
Illinois .....	20	136	96	169	164	11	150	83	178	158
Indiana .....	88	119	.....	40	114	3	95	.....	21	74
Pennsylvania, Anth.	.....	296	.....	19	.....	.....	268	.....	42	.....
Pennsylvania, Bit...	52	397	.....	285	.....	.....	236	.....	348	.....
Total .....	160	980	96	532	278	14	788	83	623	232
Grand Total.....			2046				1740			

TABLE 10.

	Mine Inspector	Mine Superintendent	Mine Foreman or Manager	Asst't or 2nd Class Manager	Firer	Hoist Enginner	Miner
Alabama .....	*	-	-	-	-	-	-
Colorado .....	*	-	-	-	-	-	-
Illinois .....	13	3	149	33	32	129	83
Indiana .....	*	-	69	37	-	46	29
Iowa .....	*	4	-	-	-	-	-
Kansas .....	*	-	-	-	-	-	-
Kentucky .....	*	-	-	-	-	-	-
Montana .....	1	1	61	32	166	62	107
Oklahoma .....	*	-	-	-	-	-	-
Pennsylvania Anthracite .....	12	-	-	-	-	-	-
Pennsylvania Bituminous .....	145	35	-	-	-	-	-
Utah .....	*	-	-	-	-	-	-
Washington .....	*	-	-	-	-	-	-
West Virginia .....	77	27	First	Class 2d Class	Class 3rd Class	Class 3rd Class	Class 3rd Class
	(a)	*	25	16	20	22	16
							46
							British Columbia
							*

\* Indicates that examinations are held, but there were none during the year 1909 or that no report is available. — indicates that examinations are not held. † includes both 1st and 2nd class firemen. (a) inspector must hold first class or superintendent's certificate. (b) examination required only when man has charge of boiler as well as engine.

*a Taken from The Education of Mine Employees by H. H. Stoeck.* Proceedings of the Mine Inspectors Institute of the United States of America. Chicago Meeting, June, 1910.

TABLE II.  
NUMBER OF MEN TAKING AND NUMBER PASSING EXAMINATIONS FOR CERTIFICATE TO MINE POSITIONS IN THE UNITED STATES  
AND CANADA DURING THE YEAR 1912.

- (a) An Inspector in Alabama must have a certificate as mine foreman but a separate examination is not required.
- (b) A blank space indicates that so far as known an examination is not held.
- (c) During 1912 examinations were not required in Colorado, but under a new law now in operation between January 1st and November 3rd, 1913, 269 persons were examined for different positions in the State; of this number 234 passed.
- (d) Indicates that an examination was held during 1912 but no figures are available.
- (e) The act requiring examination for inspectors in Indiana was repealed March 6, 1911.
- (f) Examination by Inspector but no record kept of number.
- (g) In 1912, 83 passed the examination as follows: 1st class 36; 2nd class 45; 3rd class 2.
- (h) Must hold first-class foreman's certificate.
- (i) After June 1st, 1915, an inspector must have a mine superintendent's certificate.
- (k) Mine foremen and assistant mine foremen take same examination.
- (l) Mine foremen of 1st and 2nd grade and assistant mine foremen take the same examination, hence 807 includes all applicants of whom 87 received 1st grade; 56 second grade foreman's certificates and 169 certificates of assistant foreman.
- (m) The same certificate is issued to a shot firer as to a fire boss.
- (n) This includes 1st class (800 H.P. and over) 2, 2nd class (300-800 HP.) 32. In Nova Scotia examinations are held monthly at each mine for mine examiner, shot firer and first and second-class miners.
- (o) Examinations held by Boiler Inspection Department.

The number of successful applicants in Illinois during the fiscal years 1910, 11, 12, are given in Table 12.

TABLE 12.

NUMBER OF SUCCESSFUL APPLICANTS IN ILLINOIS EXAMINATIONS, 1910-11-12.

Year	Mine Mgrs. 1st Class	Mine Mgrs. 2d Class	Hoisting Engineers	Mine Examiners	Inspectors (State)	Total
1910 .....	49	64	72	106	0	291
1911 .....	42	38	51	84	5	220
1912 .....	60	52	66	88	3	269
Total .....	151	154	189	278	8	780

*Educational Requirements in Illinois.*

The official positions in connection with Illinois mines, for which certificates of competency are required, are state mine inspector, mine manager, mine examiner, and hoisting engineer.

The technical qualifications for these positions as given in Sec. 2 of the Coal Mining Laws of Illinois, in force July 1, 1913, are as follows:

EXAMINATION FOR INSPECTORS. (b) Persons applying to the State Mining Board as candidates for appointment as State inspectors of mines must produce evidence satisfactory to the board that they are citizens of this State, at least thirty years of age, that they have had a practical mining experience of ten years, and that they are men of good repute and temperate habits; they must pass an examination as to their practical and technological knowledge of mine surveying and mining machinery and appliances, of the proper development and operation of coal mines, of ventilation in mines, of the nature and properties of mine gases, of first aid to injured, of mine rescue methods and appliances, of the geology of coal measures in this State, and of the laws of this State relating to coal mines.

NAMES CERTIFIED TO THE GOVERNOR. (c) At the close of each examination for inspectors the board shall certify to the Governor the names of all candidates who have received a rating above the minimum fixed by the rules of the board as being persons properly qualified for the position of inspector.

EXAMINATION FOR MINE MANAGERS. (d) Persons applying to the board for certificates of competency as mine managers must produce evidence satisfactory to the board that they are citizens of the United States, at least twenty-four years of age, that they have had at least four years' practical mining experience, and that they are men of good repute and temperate habits; they must also pass such examination as to their experience in mines and in the management of men, their knowledge of mine machinery and appliances, the use of surveying and other instruments used in mining, the properties of mine gases, the principles of ventilation, of first aid to injured, of mine rescue methods and appliances, and the legal duties and responsibilities of mine managers, as shall be prescribed by the rules of the board.

FOR MINE MANAGERS, SECOND CLASS. (d) Persons coming before the board for certificates of competency as mine managers, second

class, must produce evidence satisfactory to the board that they are citizens of the United States, at least twenty-four years of age, that they have had at least four years' practical mining experience, and that they are men of good repute and temperate habits; they must also submit to and satisfactorily pass such an examination as to their experience in mines and in the management of men, their knowledge of coal mining, mine ventilation and the mining laws of this State and the required duties and responsibilities of second-class mine managers, as shall be prescribed by the rules of the board, and it shall be unlawful to employ second-class mine managers, or for them to serve in that capacity at mines employing more than ten men.

**EXAMINATIONS FOR MINE EXAMINERS.** (e) Persons applying to the board for certificates of competency as mine examiners must produce evidence satisfactory to the board that they are citizens of the United States, at least twenty-one years of age, and of good repute and temperate habits, and that they have had at least four years' practical mining experience. They must pass an examination as to their experience in mines generating dangerous gases, their practical and technological knowledge of the nature and properties of fire-damp, the laws of ventilation, the structure and uses of safety lamps, and the laws of this State relating to safeguards against fires from any source in mines. They shall also possess a knowledge of first aid to injured and of mine-rescue methods, and shall hold a certificate from any national or State commission or bureau or other recognized agency.

**EXAMINATIONS FOR HOISTING ENGINEERS.** (f) Persons applying to the board for certificates of competency as hoisting engineers must produce evidence satisfactory to the board that they are citizens of the United States, at least twenty-one years of age, that they have had at least two years' experience as firemen or engineer of a hoisting plant, and are of good repute and temperate habits. They must pass an examination as to their experience in handling hoisting machinery, and as to their practical and technological knowledge of the construction, cleaning and care of steam boilers, the care and adjustment of hoisting engines, the management and efficiency of pumps, ropes and winding apparatus, and as to their knowledge of the laws of this State in relation to signals and the hoisting and lowering of men at mines.

The examinations for mine inspector were held under the supervision of the State Civil Service Commission for a period after the general State Civil Service Law became effective in July 1, 1911, but according to a ruling of the Attorney General of Illinois dated October 24, 1913, the mine inspection service is not included under this law

and now as prior to the passage of the law the examinations are given by the State Mining Board.

The Civil Service Commission holds examinations for positions in connection with the Mine Rescue Station Commission, namely: That of manager, station superintendent, and station and car assistants.

Examinations for miners' certificates have been held in the State since July 1, 1908, in accordance with a law approved June 1, 1908. In accordance with this law in each county where coal mining was carried on, a Miners' Examining Board was appointed by the County Judge.

An Act that became effective July 1, 1913, created a State Miners' Examining Board appointed by the Governor, which superseded the County Examining Boards. The provisions of this Act affecting the holding of examinations are as follows:

#### MINERS' EXAMINING BOARD.

*SECTION 1. Be it enacted by the People of the State of Illinois, represented in the General Assembly:* That hereafter no person shall be employed or engaged as a miner in any coal mine in this State without having first obtained a certificate of competency and qualification so to do from the "Miners' Examining Board" of this State, created by this Act: *Provided, however,* that any such certificated miner may have one person working with him and under his directions as an apprentice for the purpose of learning the business of mining and becoming qualified to obtain a certificate in conformity with the provisions of this Act.

§ 2. The Governor shall, by and with the advice and consent of the Senate, within thirty days after this Act shall take effect, appoint three persons as Miners' Examining Commissioners, who shall constitute the "Miners' Examining Board," of the State of Illinois, and who shall hold office as follows: One of said appointees shall hold office until March 1, 1914, one until March 1, 1915, and one until March 1, 1916, and on the first day of March of each year after this Act shall take effect, one member of said board shall be appointed and the term of office thereafter shall be three years for each member, or until his successor is appointed and qualified. Two of such commissioners shall constitute a quorum. Said commissioners shall hold no other lucrative office or employment under the government of the United States, State of Illinois, or any political division thereof, or any municipal corporation therein and each commissioner before entering upon the duties of his office shall subscribe and take the oath prescribed

by the Constitution of this State, and shall before entering upon the duties of his office give a bond with sufficient surety to be approved by the Governor, payable to the People of the State of Illinois, in the penal sum of five thousand dollars (\$5,000), conditioned for the faithful discharge of his duties of office and delivery of all records, books, moneys, and other property pertaining to his office to his successor in office, which said bond shall be deposited in the office of the Auditor of Public Accounts.

§ 3. No person shall be appointed such miners' examining commissioner who has not had at least five years' practical and continuous experience as a coal miner and who has not been actually engaged in coal mining as a miner in the State of Illinois continuously for twelve months next preceding his appointment: *Provided, however,* that a commissioner may be appointed to succeed himself.

§ 4. Each of said commissioners shall receive a salary of fifteen hundred dollars (\$1,500.00) per year, payable monthly, such salary to be paid on the certificate of the president of said board, verified by the commissioner receiving the same, and approved by the Governor.

§ 5. Immediately after the appointment or reappointment of a commissioner in each and every year, the said board shall organize by selecting one of its members president and another secretary for the ensuing year, and all records, reports, books, papers and other property pertaining to the office of said board shall be kept by the secretary. The secretary shall be provided with a seal with proper device and on the margin thereof shall be the words "Miners' Examining Board, State of Illinois."

§ 6. Such board shall hold an examination once in each calendar month, in at least twelve places located most conveniently with reference to the districts in which coal is mined in the State of Illinois so that all persons in such district or in this State, or who may wish to come into this State, for the purpose of engaging in mining, may be examined as to their competency and qualifications. Notice of the time and place of such examinations shall be published in some newspaper of general circulation printed in the English language and published in the vicinity where such examination will be held. Such notice shall be published at least three times before the date of such examination, the first publication not less than seven days before the examination is to occur. If there is not such newspaper published at the place of such examination, then such notice shall be published in the newspaper nearest to the place of such examination.

§ 7. Each applicant for the certificate provided for herein shall pay a fee of \$2.00 to said board. Fees so collected during each month,

shall, before the 10th day of the following month, be paid by the board to the State Treasurer, together with a report showing where and from whom each fee was collected.

§ 8. All examinations held by said "Miners' Examining Board" shall be conducted in the English language and shall be of a practical nature so as to determine the competency and qualification of the applicant to engage in the business of mining. Said board shall examine under oath all persons who apply for certificates as to their previous experience as miners and shall grant certificates of competency or qualification to such applicants as are qualified, which certificates shall entitle the holder thereof to be employed as and to do the work of miners in this State. No certificate of competency shall issue or be given to any person under this Act unless he shall produce evidence of having had not less than two years' practical experience as a miner or with a miner, and in no case shall an applicant be deemed competent unless he appear in person before said board and orally answer intelligently and correctly at least twelve practical questions propounded to him by the board pertaining to the requirements and qualifications of a practical miner. Said board shall keep an accurate record of its proceedings and meetings and in said record shall show a correct detailed account of the examination of each applicant with questions asked and their answers, and at each of its meetings the board shall keep said record open for public inspection. No miner's certificate granted under the provisions of this Act shall be transferable and any effort to transfer the same shall be deemed a violation of this Act. Such certificates shall be issued only at meetings of said board and said certificates shall not be legal unless signed by at least two members of said board and sealed with the seal of the board issuing such certificates.

§ 9. Said board shall annually on the first day of March, report to the Governor, in writing, what examinations it has held and what work it has done during the preceding year, together with such recommendations as it may deem advisable for the improvement of the method of holding examinations and carrying out the purpose of this Act.

§ 10. No person shall hereafter engage as a miner in any coal mine without having obtained a certificate of qualification as provided for in this Act, nor shall any person, firm, or corporation employ as a miner in his, their or its mine in this State, any person who does not hold such certificate, nor shall any mine foreman, overseer, or superintendent permit or suffer any person to be employed under him or in

any mines under his charge or supervision as a miner in any mine in this State, except as herein provided, who does not hold such certificate of qualification. Any person, firm or corporation who shall violate or fail to comply with the provisions of this Act, shall be deemed guilty of misdemeanor and on conviction thereof shall be fined in any sum not less than one hundred dollars (\$100.00), and not more than five hundred dollars (\$500.00), or shall be imprisoned in the county jail for a term of not less than thirty days, nor to exceed six months, at the discretion of the court.

§ 11. It shall be the duty of said "Miners' Examining Board" to report all complaints or charges of non-compliance with, or violation of the provisions of this Act to the State's Attorney of the county in which such non-compliance or violation occurs, and it shall be the duty of the State's Attorney of the country wherein the complaints or charges are made, to investigate the same and prosecute all persons so offending.

§ 12. In order to more effectively carry out the intention and purposes of this Act, the "Miners' Examining Board" shall have power to administer oaths to any and all persons who are applicants or may vouch in any manner for the service or qualification of any applicant in order to obtain for him a certificate hereunder, and any person who shall wilfully swear or falsely testify as to any matter material to such examination or as to the service or qualification of any applicant, shall be deemed guilty of perjury and shall be subject to the penalties thereof as prescribed by the criminal code of this State.

§ 13. The Governor shall have the power and authority to remove any of said commissioners for neglect of duty, incompetency, or malfeasance in office, and upon such removal shall appoint a successor.

§ 14. The validity of any section or part of this Act, shall in no manner affect the validity of any other part of this Act, exclusive of such invalid part or parts, if any.

§ 15. That an Act entitled, "An Act to amend an Act entitled, 'An Act to provide for the safety of persons employed in and about coal mines, and to provide for the examination of persons seeking employment as coal miners, and providing penalties for the violation of the same, approved June 1, 1908, in force July 1, 1908,' approved June 5, 1909, in force July 1, 1909," be and the same is hereby repealed.

APPROVED June 27, 1913, in force July 1, 1913.

## METHOD OF CARRYING ON INDUSTRIAL MINING EDUCATION.

Industrial Mining Education has been carried on up to this time in the United States by the following methods:

1. Short Courses in Mining Colleges.
2. Industrial Mining Schools.
3. Night Classes.
4. Lecture Courses.
5. Correspondence courses.

It is unnecessary to attempt to describe all of the forms now being carried on under these various heads as in many places the work is essentially the same. A few only of the characteristic methods, therefore, will be described:

### SHORT COURSES IN MINING COLLEGES.

A number of the mining schools and mining departments in universities have courses varying in length from a few weeks to two years. These courses are somewhat similar to the agricultural courses given by many institutions during the winter months, but while the farmer usually has a slack time during the middle of the winter, when he can easily leave home, there is no such definite slack time in coal mining regions, unless it be during the summer months and in many localities the weather is then not conducive to study.

The requirements for admission to the two-year courses are usually an elementary knowledge of mathematics and English and the subjects studied are surveying, mechanical drawing, elementary physics, chemistry and mathematics, general mining principles, mine ventilation, and the mining law of the particular state or locality in which the school is located. Many men have undoubtedly been benefited by these courses, but their influence is limited, because so few of the men for whom they are designed have the time or means to give up their daily work to carry on such courses.

Short courses may be grouped under two heads:

- (a) Those extending over a period of a few weeks.
- (b) Those lasting a year or more, usually two years.

Short courses extending over a few weeks are now being offered or have been offered during recent years by the Pennsylvania State

College, Ohio State University, University of Illinois, University of West Virginia, University of Washington, University of Kentucky, and probably by a number of other institutions.

A brief description of a few of those from which the writer has recent information will answer for all, as they are very similar in character, and differ mainly in the arrangements made necessary by local conditions.

#### *University of Kentucky.*

An eight weeks' course was carried on at the University of Kentucky during the summer of 1913, and Professor H. D. Easton, Professor of Mining Engineering, University of Kentucky, who was in charge, says:

"The 'Practical Miners' Course' opened at the Kentucky State University in 1908 as an eight weeks' term; in 1909 it was changed to a ten weeks' term and continued so until 1913, when it was again changed back to an eight weeks' term. I have found that eight weeks is better than ten for the class of men we have been getting to come: it is difficult to get men to come to any but a short course.

"This year we had thirty-four in attendance, about twice as many as any year before, and nearly all of them are mature men who have always worked in coal mines. We have had two men fully sixty years old, and quite a number who had reached the age of forty-five.

"Special emphasis is always placed on methods of mining, ventilation, mine gases, safety lamps, explosives and mine explosions. Arithmetic and some elementary chemistry are taught but NOT as separate subjects: these subjects MUST be mixed with the other work or they will discourage coal diggers.

"I teach by blackboard talks and by the use of charts, sketches and small apparatus such as small fans, water gauges, anemometers, samples of explosives, safety lamps, etc. There is no text suited to this class of men.

"During the years this course has been running, not a man has failed to pass the mine foreman examination after completing the course. Three of these men returned and took the course a second time, having obtained mine foreman certificates the first time. They devoted nearly all of the second term to surveying and other advanced work: four of them have become Assistant State Mine Inspectors: at least four are now superintendents of coal mines: several hold positions as mine foremen at large mines: while the larger portion of them are again digging coal. The largest coal company in Kentucky has

four of these men as mine foremen, and this company is now trying to get several more.

"I mention these things to show two points: First, we have been able to get a high class of miners to come to this course; Second, the course has a real standing among our coal operators.

"While we have very few foreigners in Kentucky yet two of the very best men are Italians."

#### *University of West Virginia.*

The West Virginia University offered a summer course in Mining during the summer of 1913 and a similar course will be again offered in 1914. The subjects included in the curriculum announced for 1914 are mine gases, explosives, ventilation, accidents, machinery, rescue and first-aid work, mechanical drawing, law, blasting, and mathematics. The prospectus also announces inspection trips to adjoining mines, and lectures by mining men on current mining topics.

#### *University of Washington.*

The short course offered at the University of Washington will serve as a good example of the work being done for the workers in metalliferous mines and smelters. The following description is taken from information furnished by Professor Joseph Daniels, of the Mining Engineering Department, University of Washington, and from an article by him in the Proceedings of the Society for the Promotion of Engineering Education. Boston meeting, 1912, Vol. XX, part 2, p. 436:

"For fifteen years the College of Mines of the University of Washington has offered a short course in Mining Engineering to the mining men of the Northwest. The course begins during the first week in January and extends to April first,—a period of three months during which many of the miners are not at work. The session has been open to all men without any particular regulations in regard to entrance or preparation; an interest in the work is presupposed. Announcement of the Short Session is made in the University Catalog, the Mines College Bulletin, in the mining journals, and in the newspapers of the mining states of the Northwest, Alaska, and British Columbia. In addition to this, an announcement is mailed to all former students, to men who have previously written for information, to mine officials, and to clubs and organizations where mining men meet.

The subjects offered in the course are as follows: metal-mining and milling; mine surveying; mining law; geology; mineralogy; general chemistry and qualitative analysis; fire assaying; metallurgy; placer mining; coal mining and rescue training; mine tim-

ber framing; and forge. This work is given by the regular members of the University staff in the various departments and differs only in extensiveness from the work offered to the undergraduate students. Of the ten instructors who gave courses this year, five are mining engineers with experience in the various mining camps of the country. The lecture and laboratory work is supplemented by addresses given by outside engineers and by trips to the nearby mines and smelters.

The relative time per week allotted to these subjects follows: mining and milling, 2 lectures and 1 afternoon laboratory period; mine surveying, 2 lectures and 2 afternoon's field work; mining law, 1 lecture; geology, 2 lectures; mineralogy, 2 laboratory periods; general chemistry and qualitative analysis, 3 lectures and 1 afternoon laboratory period; fire assaying, 1 lecture and 3 afternoon laboratory periods; metallurgy, 2 lectures and 1 afternoon laboratory period; placer mining, 3 lectures; rescue training, 25 hours' work in smoke-room and first aid practice, and lectures arranged to meet needs of student; forge and mine timber framing, 1 afternoon each.

Of the subjects outlined above, most of the short session men elect mining and milling, chemistry, fire assaying, mineralogy and geology, and mine surveying. A few choose placer mining; occasionally the coal-mining work is selected. Chemistry and mineralogy are prerequisite for the work in fire assaying; outside of this any combination may be taken.

The expense to the student is very small. Laboratory deposits sufficient to cover cost of materials used are required in assaying, chemistry, and mineralogy. Twenty-five dollars will normally cover this expense and the cost of text books and general supplies. Provision is made for taking care of these men at the University dormitory at a cost of \$2.50 per month for room and \$17.50 for board. Accommodations outside the campus average higher in cost, but vary widely.

The registration varies from year to year as the accompanying figures for the last ten years show.

1903.....	26	1908.....	26
1904.....	28	1909.....	15
1905.....	20	1910.....	8
1906.....	16	1911.....	27
1907.....	19	1912.....	22

Most of the men remain during the entire period, a few drop out as their interest wanes or the chance of work draws them back to camp, still others remain long after the session closes and continue to work

independently under the direction of some of the instructors. Occasionally a man will remain for an entire semester and earn regular credits with the idea of using these to continue other University work at some later period. Five men of the 1912 group returned for the second time. One man remained to work for a degree and obtained it.

In addition to the registration figures shown above, the College of Mines receives a number of the coal-mining men who come during the year to take the rescue-training and first-aid-to-the-injured work given at the Bureau of Mines Rescue Training Station. These men are given regular lectures on the Geology of the Pacific Coast, origin of local coals, coal analysis, and mine gases and explosions; and laboratory demonstration in fuel analysis and coal washing. This work extends over the period of training, two hours a day for two weeks.

The great majority of the short session students have had mining experience in occupations as prospectors, miners, mine and smelter superintendents, and mine owners. On the other hand, a number without any previous experience intend to go into mining work in various capacities or they are interested in mining ventures and take the course for the general information and training. In this latter group have been business men, doctors, and lawyers.

The following statistics of the 1912 class may be of interest:

Age	Residence	Born	Education
52	Alaska	Denmark	.....
48	Washington	Maryland	.....
31	British Columbia	Wisconsin	.....
36	Washington	Scotland	.....
42	Washington	Sweden	.....
22	Washington	Ohio	{ High School College
29	Washington	California	.....
20	Washington	Montana	High School
43	Montana	Ireland	I. C. S.
34	Alaska	Utah	High School
33	Washington	Norway	.....
37	British Columbia	Wales	{ Technical Classes
56	Washington	Wisconsin	.....
28	Alaska	California	.....
34	Washington	Ontario	High School
39	Washington	Minnesota	{ High School
22	Tennessee	Tennessee	{ Seminary College
29	Alaska	Pennsylvania	High School
34	Washington	Ohio	{ High School College
29	Russia	Russia	.....
36	Washington	Kansas	{ High School I. C. S.

The ages vary from 20 to 56 years; the usual residence given is Washington, as most of the men spend the "lay-off" season around Seattle; a number are foreign born and there are no "native sons" in the list; the educational opportunities for most have been limited. An interesting fact is to find men who have attended colleges. None of this year's men were graduates, but in the past years a number of non-mining graduates have taken advantage of the unusual opportunity to obtain quickly and directly the mining knowledge which they immediately required.

From the standpoint of the College of Mines, the Short Session is valuable to the regular students and the instructors alike. Men who have been facing the realities of mining for a number of years bring to the University environment a touch of the outside world and an attitude toward the work that is stimulating to the undergraduate. The technical information and news of the mining camps keeps the instructors in better touch with the mining activity around them. Finally the contact and association between these men and the Faculty and students creates a better feeling of understanding in the problems of mining that deal with the relationship of trained men to the industry. No Short Session miner can go away with the feeling that a college trained engineer is a snob and afraid of work, and the undergraduate learns to respect the sterling worth and purpose of the man who is limited by lack of training, and to place higher value on his own opportunity."

In a letter dated August 19, 1913, Professor Daniels says:

"We find most difficulty in informing the mining men that our Short Session exists. You see the men are scattered all along the coast from Alaska to California and naturally the field is difficult to cover adequately. However, this year, in addition to sending press notices to the various papers in the mining towns, we are having large posters printed which we are sending to postmasters to be hung in their offices. We also reach the various clubs, hotels and organizations where mining men meet in Seattle. As a rule we find that the metal mining men respond more generously to our call, as the camps usually close up during the winter months and they spend the time in Seattle. The coal mining men are unable to come from January to April, but we get an occasional man who comes in for the Rescue Training course at the station on the campus. Most of the coal men would like to have the work, but they cannot afford to leave their occupations for three months in the year, and many of them in the mining towns have said to me that they thought the University should come to them in some

way. We are hoping that in some way we can do lecture work thruout the camps, but as yet plans along this line have not fully materialized."

### *Pennsylvania State College*

The Pennsylvania State College for a number of years offered two year courses in Mining. Dr. W. R. Crane, Dean of the School of Mines, says in regard to these courses:

"The short courses in mining, that we offered some two years ago, have not met with success. During the year preceding the announcement of these courses I lectured to thirty-five hundred men in the bituminous coal fields. At the time of the lectures slips were passed around with the request that everyone present write his name and address, as well as the position that he occupied. It was further stated that these addresses would be used in the distribution of information on practical mining subjects. Before the opening of school, the following fall, outlines of courses had been sent to each address with a request that those interested communicate with us. Only thirty-five men responded, but when the time arrived for them to come to the college to take up this work not a single individual found it convenient to do so.

"During the past summer we had one of our instructors in the field conducting mining classes, but owing to the lack of interest shown and the consequently small attendance the work was dropped. The following is an extract from a report of this night school work by Professor D. H. Pallister who was in charge of it:

"During the last college year there was considerable agitation toward the starting of night schools in mining as an extension of the work of the School of Mines.

"In cooperation with Mr. T. B. Dilts, Mining Educational Secretary of the State Y. M. C. A. of Greensburg and Mr. H. C. Yerger, Superintendent of Mines, Pennsylvania Coal and Coke Corporation, free night schools were started in different mining towns in Cambria County, at which the Pennsylvania Coal & Coke Corporation has operations, and to draw from all the mines in the neighborhood irrespective of companies. The meetings were to be held once a week and the course to be one of eight weeks. It was decided to make a charge of one dollar a month to keep out any disinterested parties and this money was to go toward paying the expenses of the instructor, the deficit being made up by the Pennsylvania Coal & Coke Corporation.

"After having advertised the work through the local and county papers, and with the assistance of the mine superintendents and the

mine foremen at the various works, the classes were organized on July 14th.

"The attendance was good at several of the places on the opening nights, but when it became known that it was not to be a series of lectures and that each man would have to do problems of a simple nature after similar problems were worked out and explained, many of the men would not join the classes due to diffidence, lack of incentive and laziness, while many others who joined dropped out for no apparent reason after the first session. Of the 41 men enrolled in the classes but 11 attended during the fifth week, as shown below:

Town	1st Week	5th Week	Total	Enrolled
Ehrenfeld .....	9	1		9
Hastings .....	4	4		6
Patton .....	4	1		9
Moss Creek .....	13	4		13
Gallitzin .....	4	2		4
	—	—		—
	34	12		41

"On going over the attendance with Mr. Yerger, it was thought advisable to discontinue the work after the 5th week because of the expense which amounted to over \$60.00 per month for only 11 students, making the amount to be paid by the coal company rather high.

"In the instruction, an attempt was made to give each man individual instruction from the point which he had reached in school or through other sources and to instruct them in mine gases, ventilation, mine laws and safety, and other lines which would ultimately prepare them for state mine foremen or mine fireboss examinations or fit them for various positions, and above all train them to be more efficient. The work, however, in most cases had to start with a course in arithmetic. The majority of men working in the coal mines are foreigners, a great many of whom cannot read or write English thus making it necessary to require work in that line before they can be taught mining. The balance are made up of men who don't care; those who are willing to take an education if it can be acquired by them without effort; and a much smaller number who are in earnest. This last, small portion, is made up of two classes, (a) those with a little education secured in night schools, correspondence courses, etc., with whom it is a pleasure to work, and (b) those with no foundation or who have forgotten the one or two years of grade school work they have had, and are very hard to teach but have the making of good students.

"These last two divisions make up the part of the class on which one has to rely, but at no town were we able to get together enough of them to continue to hold a class.

"In conclusion I might say that though the experiment was a partial failure, nevertheless we have learned a number of things.

The poor attendance in the classes may be attributed to:

1. Work done in summer time and so interfered with by other attractions.
2. Classes held in small towns (2000 or less) with a correspondingly small number of men to draw from.
3. The work is an innovation and men are suspicious.

"It would seem advisable to cooperate with the grade schools and have them establish night schools in which elementary work might be done. The men could then be taken after they had completed such work, or equally good results might be had by working with the men, say one night a week. In either case we could accomplish a great deal of good. By forming classes in "Mining" in the larger towns, as Greensburg, Johnstown, Connellsville, etc., where there is a large population to draw we could possibly secure better results and make a beginning by getting the men in the smaller towns interested.

"On the other hand a series of lectures on state coal mining laws, and safety and general mining would be very well attended."

#### *University of Pittsburgh.*

The extension work carried on by the School of Mines of the University of Pittsburgh is described by Professor H. B. Meller as follows in a letter dated December 6, 1913:

"In conjunction with the Secretary of the Y. M. C. A. for the bituminous region, classes were organized as follows: Republic, California, Connellsville, West Newton, Irwin, Monongahela City and Marianna.

"The total enrollment in the classes was 152. Of this number only 50 completed the work and took the examinations. Of those who took the examinations, all but two received certificates. Each class was met by our instructor once a week.

"The work is carried on principally by lectures. Last year, we used as a basis the Coal and Metal Miner's Pocket Book. This year we have prepared our own notes. The work is intended to cover mine gases and explosions, safety lamps and their use, the principles of ventilation, and such mining law as the candidates for certificates would be expected to know. This is about all we can take care of in the time. The salary of the instructor is paid by the University. No fee is charged the miners, they being expected to take care of the traveling expenses of the instructor.

"So far this year, we have organized but five classes, averaging twenty men each. As you probably know, in work of this kind it is

very difficult to hold the men throughout a course. Many of them come for the first lecture, and do not return. Some go through half the course, and then drop out. As stated above, last year only one-third of those who registered took all of the work.

"It is our purpose to supplement the notes and lectures with illustrations, and for this purpose we have purchased a portable lantern and a portable projectoscope. These instruments are arranged to use either direct or alternating current, of either 110 or 220 volts, and may be connected to an ordinary light socket. We make use of what slides we have and can obtain, and where we desire to illustrate something for which we have no slide, we procure a catalogue or magazine illustration, or prepare a drawing, and project it directly. The projectoscope works about as well as instruments of this character can, and the results, while not all that we would desire, are fair.

We expect to extend the work just as rapidly as funds become available, with the idea that eventually the entire district will be covered. This will take about two hundred classes, and approximately thirty-five men."

#### *Oklahoma School of Mines and Metallurgy.*

The extension work of the Oklahoma School of Mines and Metallurgy at Wilburton, Oklahoma, is described by acting President E. P. Barrett under date of January 14, 1914, as follows:

"In 1910 and 1911 we carried on Night Schools in Wilburton, Krebs, and Hartshorn. In Krebs and Hartshorn we held only two nights each week teaching arithmetic only, to classes of forty to seventy men. In these classes were men who could only add, men who could add fractions, men who could work decimal fractions, etc. This suggested the plan we now follow of giving each man personal instruction. Each man represents a class and takes up the work where he is able to handle it, using the books gotten out by the School of Mines. In Wilburton where the entire faculty could be used we had as many as five classes giving work in arithmetic, algebra, geometry, trigonometry, and surveying.

"In 1912 and the early part of 1913 we carried on Night Schools in Wilburton and Colgate. At Colgate there were one hundred twenty five men enrolled with an average attendance of seventy five. The work consisted of arithmetic, mine gases, mine ventilation, and steam boilers and generation.

"At present we are conducting Night Schools in Wilburton, Krebs, Colgate, Miami, and Hattenville. We also intend to start Night Schools in Lehigh, Adamson, and Henryetta.

"Our work has enabled a great many men to secure certificates from the State Mining Board."

The University of Kansas under date of October 1913 in Engineering Bulletin No. 4 announced vocational industrial courses for home study and among them are courses in mine accidents, origin and occurrence of coal explosions, mining methods, ventilation, haulage and hoisting, origin and occurrence of salt, first aid and rescue work.

Several institutions have offered definite courses extending over a period of one to two years, one of the oldest and best known courses being that offered by the Ohio State University, but no data are available for publication in regard to this course.

Complete details in regard to the short mining courses offered by the Department of the University of Illinois through the Illinois Miners' and Mechanics' Institutes will be given in Bulletin 2.

#### INDUSTRIAL MINING SCHOOLS.

##### *Freeland Mining and Mechanical Institute.*

Mr. Eckley B. Coxe, the eminent mining engineer was foremost in working for the passage of the mining laws in Pennsylvania that gave an impetus to industrial mining education in that State in 1885. He was also, so far as available data show, the pioneer in instituting industrial mining education in America.

In 1879, Mr. Coxe in a presidential address before the American Institute of Mining Engineers outlined a plan for a night school for boys and men who had to work during the day. This was not intended as a competitor of the public schools, but to supplement them and was meant for those who could not attend the public schools. This school, patterned after the German Steigerschule, was established at Drifton, Pa., Mr. Coxe's home, May 7, 1879, and has been in continuous operation ever since. The school was moved to Freeland, a larger town about one mile from Drifton, in 1893, and in 1903 an excellent building was erected for it. Classes in elementary mathematics, physics, chemistry, mechanical drawing, first aid to the injured and the science of mining have been carried on by a resident principal assisted by the engineers associated with the mining interests with which Mr. Coxe was connected. Since the death of Mr. Coxe and the absorption of his mining interests by the Lehigh Valley Coal Co., this school has been supported by his widow, and by other contributors. During its history not only have large numbers of young men, and older men as well, been prepared for the State examinations for mine inspector, mine foreman and assistant mine foreman, but quite a number of young men



have received their preliminary training for entrance into technical institutions of higher grade, and a number of graduate engineers point back with pride to the school not only as their place of preparation, but also as having given them the incentive for obtaining a higher education along engineering lines. The courses have gradually developed until now there is not only the night school with elementary courses in mining and mechanical engineering, but also a day college preparatory course. The tuition is 50 cents per month payable in advance. There is no age limit and no particular entrance preparation required, entrance depending largely upon the judgment of the principal.

The work of the day school is not pertinent to the present inquiry, excepting that the development of such a college preparatory school is significant as one of the results that may be accomplished in a mining community by a movement that as started pertained exclusively to mining industrial education. From 1894 to 1911, 218 students were enrolled in the night classes an average of 12 per year and of these there was an average daily attendance of 7. Prior to 1900 there were no foreign-speaking men enrolled in these classes. In that year one foreigner enrolled and there has been a gradual increase in the attendance of such men.

#### *Wisconsin State Mining Trade School.*

The Wisconsin State Mining Trade School, established by the State Legislature in 1907, is supported by state appropriations and is under the supervision of a Board of Regents, of which the State Superintendent of Public Instruction is a member, ex officio. Two other members are appointed by the Governor.

The school is located at Platteville in the lead and zinc district of southwest Wisconsin, and the buildings used were formerly occupied by one of the State Normal Schools. No tuition is charged students from the State of Wisconsin, but for others the tuition fee is fifty dollars (\$50.00) per annum. Laboratory fees for all are about twenty dollars (\$20.00) per annum.

According to the statute creating the school, the course is two years in length and includes "geology, mineralogy, chemistry, assaying, mining and mine surveying and such branches of practical and theoretical knowledge as are in the opinion of the Board conducive to the end of enabling students of said school to obtain a knowledge of the science, art and practice of mining and the application of machinery thereto." As this is the first mining trade school established in America in an ore mining district its progress and development will be watched with much interest.



Mining trade schools are as yet too young in the United States for any conclusions to be drawn as to their success or failure.

The School at Freeland, Pa., established by Mr. Coxe has undoubtedly done excellent work, but an average enrollment of only 12 in the night school in a region where coal mining is practically the only industry and in a state where an educational requirement for mine foremen has long been in force, and where even the miner must pass an examination before being allowed to work in the mines indicates that such a trade school does not solve the entire problem of secondary mining education. Conditions in the United States differ so radically from those in Germany, for instance, that the type of German trade schools may or may not succeed here.

#### NIGHT CLASSES

##### *Lehigh Valley Coal Company Night Schools.*

In 1909 the Lehigh Valley Coal Company with headquarters at Wilkesbarre and mines throughout the anthracite coal fields established at Lost Creek, Pennsylvania, a night school for its employees. A two-room building was renovated and attractively fitted up, one room as a regular school-room and the other for more general purposes. This school was at first especially designed for employes of the Lehigh Valley Coal Company who were already taking correspondence school courses. In order to help such students a public school teacher, who had been raised in the mining regions, was employed to give instruction two nights per week. It was understood that in appointing men to positions of responsibility, and in promoting men, the company would give preference to those who were trying to improve their knowledge of mining by study. The Lost Creek school was soon after its establishment opened to all applicants whether employees of the Lehigh Valley Coal Company or not, and whether or not the applicant was already taking a correspondence course, so long as the school rooms would accommodate the applicants. Thus far no applicant has been refused.

Upon the opening night over seventy applied for admission and after a short time it became necessary to keep the school open four nights per week. The Lost Creek school has been operating continuously to date, and so successful was it at the very start, that a similar school was opened by the Lehigh Valley Coal Company at Centralia, Pa., March 16, 1910. This school has also been operating continuously to date and as no restrictions upon attendance have been placed since the school was first opened, an account of its operation will be of more general interest than a similar account of the Lost Creek school.

The following statement in regard to the Centralia school is based upon data furnished by the Lehigh Valley Coal Company:

Two instructors were employed at this school, and between the date of opening, March 16, 1910 and the closing for the summer, June 14, 1910, 48 sessions were held. Upon the opening night 36 students enrolled and upon the closing night there were 63 students in attendance, of whom 58 were employees of the Lehigh Valley Coal Company, two employees of other companies and three not employed by the coal companies. The attendance averaged 49 per cent throughout the school period. Two classes were held: Class "A" comprising students enrolled in the International Correspondence Schools, which met Monday and Thursday nights, and Class "B" including students not enrolled in the Correspondence Schools, which met Tuesday and Friday. The average attendance of Class A was 21 students and of Class B, 7 students. Those in Class A studied mining, surveying, mapping and mechanical and electrical features of mining. Those in Class B studied arithmetic. Six of the sixty-three students were foreign men.

The second year of the school opened September 6, 1910 with 63 students in attendance and closed June 14, 1911, with 103 students, of which number 86 were employees of the Lehigh Valley Coal Company, 4 employees of other coal companies, and 13 were not employed by coal companies. 148 sessions were held, and the attendance averaged 52 per cent. As in the previous year there were two instructors and two classes, A and B. The average attendance of Class A was 15 and of Class B 12. 5 of the students were foreign men. The subjects studied in Class A were the same as in the previous year and those in Class B included advanced arithmetic.

The third year, school opened September 7, 1911 with 103 enrolled and closed June 14, 1912 with 143 enrolled, of whom 118 were employees of the Lehigh Valley Coal Company, 9 employees of other coal companies, and 16 not employed by coal companies. Of those attending 58 were correspondence school students. Two classes were carried on, the subjects studied being about the same as in the previous years. The average of attendance of Class A was 15 and of Class B 12. The total number of sessions held was 148 and the percentage of attendance 51.

The fourth year of the school opened September 9th 1912 with 143 students enrolled and closed June 10, 1913 with an enrollment of 209 for the year. Of this number 116 finished the course and 2 were dropped for not attending. Of the 209 enrolled during the year, 179 were employees of the Lehigh Valley Coal Company, 18 of other coal companies and 12 were not employed by a coal company. Sixty-four

were taking courses in the International Correspondence Schools. Two classes were carried, on the A and B, the average attendance in the A class being 15 and in the B class 20.

#### *H. C. Frick Coke Company Night Schools.*

The H. C. Frick Coke Company with headquarters at Pittsburg, Pa., has established night schools quite similar to those operated by the Lehigh Valley Coal Co. and described on page 49. The following account of the school work carried on by the Frick Company has been furnished by Mr. W. H. Glasgow, Assistant to the General Superintendent, under date of November 20, 1913:

"The H. C. Frick Coke Company has for some years past been conducting night schools at several of the plants with a view to teaching the foreign speaking employes the elementary branches, such as reading, writing and arithmetic, and preparing the more advanced students for the examination for Mine Foreman, Assistant Mine Foreman and Fire Boss certificates. Last winter we took advantage of the provision in the school code for vocational schools and assisted in the establishing of night schools at a great number of our plants. Thus far this winter we have succeeded in starting only six night schools, five additional will be started in the next week, and several more are on the way and will be started a little later.

"In addition to the schools we have within the past year supplemented our regular lecture work on safety and welfare with lantern slides and motion picture films, using one of the latest type of the Powers motion picture machines. The illustrations usually include two or three films illustrating industrial conditions and the right and wrong methods of doing work; also ninety-eight plates showing the right and wrong method of doing work in connection with mining coal, handling explosives, timbering, handling cars of coal, etc., all of which is fully explained by the lecturer. We have also been using twenty-six plates showing gardens and sanitary conditions in and about our mining towns. The lecture, with the above illustrations, was given at each of the works of this company during the past summer, and then sent to the other mining companies of the United States Steel Corporation, and in a number of cases the equipment has been loaned to other mining companies outside of the corporation for similar use.

"We have also had printed much literature with reference to safety and welfare work, which has been distributed to all employees of this Company, and we now have in the hands of the printer a booklet showing half-tone illustrations of the right and wrong methods of doing various kinds of work in and about the mines, with a full ex-

planation under each of the illustrations. We propose giving one of these booklets to each of our employes.

"We also use a bulletin board at our plants where we place in a conspicuous place notices and literature of interest on the subject of safety and welfare."

The author of this bulletin visited a night school at Tarr Station, Pa., conducted by the H. C. Frick Company in cooperation with the local school officials. This school is kept open two hours each night for five nights per week, and is conducted quite similar to any ordinary day school, the same textbooks being used as in the day school. No particular attention was paid to specialized vocational training at the time of our visit though the school had been in operation only a few weeks and the plan of those in charge included the incorporation of vocational work as soon as possible. The students studying in the first, second, and third readers attended Monday, Wednesday and Friday nights and those in the fourth and fifth reader, Tuesday and Thursday nights. Of the 35 enrolled in the former class 28 were present at the time of our visit, ranging in age from twelve years to fifty and including many nationalities, nearly all being recent immigrants or the children of such immigrants. The teacher was paid \$30.00 per month.

#### *The Cleveland-Cliffs Iron Mining Company School.*

In 1912 the Cleveland-Cliffs Iron Company with headquarters at Ishpeming, Michigan, established a school for the training of foremen.

Letters from Mr. M. M. Duncan, Agent, (General Manager) of the Company and Mr. W. H. Moulton, in charge of the sociological work of the company give the following account of the work as carried on thus far:

"Our educational work has now been continued for something over a year, and we have had in the different classes 128 men.

"This work has been conducted at the Ishpeming, North Lake, Negaunee, and Gwinn Districts. The men have taken up arithmetic, including fractions, and mine mapping and mine surveying. With these studies they have been given talks to interest them in geology and general mining problems.

"We have other subjects for study under preparation at the present time which include time-keeping, sampling, and the various features of mine work. Our plan is to prepare these in short unit courses, so that they will be a definite practical value for each series of lessons.

"Only enough work on general geology is being taken to make the student capable of understanding the work further on. The emphasis is being laid on the structural part of geology and on the genesis and occurrence of the iron ores of the Lake Superior region.

"In surveying the object is to give the men a thoro working knowledge of the use of the compass and of the Brunton pocket transit. Under the heading of mapping the men are taught how to construct maps, especially underground maps, and how to make use of a blue print or tracing. Each man constructs two or three maps from surveyors' notes of different parts of the mine in which he works, the maps in all cases being constructed by the use of protractor and scale. Considerable time is given to the graphical solution, from tracings, of such problems as determining the line to be given to connect two drifts, or the angle and direction necessary to connect two points by a raise. Under the two headings, time keeping and drilling machines, besides the actual work of time keeping, some work has been taken to bring out the business side of mining as well as to teach the men the use of the various forms used by the Company for the proper distribution of supplies.

"The drills are studied from sections of various makes and from complete machines. The men are taught to take them apart and put them together, studying how they work at the same time from the sections. Particular attention is paid to the common breakages that occur to the machines underground.

"The subject of electricity is taught by the chief electrician to a selected group of men who are regularly employed in the maintenance and operation of electrical equipment. These men are taught the fundamental principles of magnetism and current electricity, electric wiring, the operation of direct and alternating current dynamos, armature winding, drawing of wire diagrams and simple electrical devices and the transmission of power at high voltages.

"We have found a good deal of difficulty in keeping up a regularity of attendance, especially in the summer time, as most of the men here have gardens and get a great deal out of them, and for this reason we have not tried to continue the school during these months.

"At first the sessions were held in the evening, but we found the men tired and somewhat unfit for active mental work. We later changed over and the classes were held in the afternoon, these men being on the night shift that week. We found that the men did not regularly sleep in the afternoon, and we were able to make use of this time.

"We have made quite a little use of our stereopticon lantern and expect to use it even to a greater extent in this work.

"The papers on the mine subjects will be prepared by the Director with the help of the superintendents and engineers, so that they will be practical and provide for the men to be taught our practical methods of doing work.

"The remaining courses are not as yet sufficiently worked out to be described here. The idea we have in mind at present is to have a series of courses that will take up different phases of the mining work, in about the same order that these operations take place in practice. That is, we would start with a course on exploration work, follow that with shaft sinking, shaft timbering, etc., then follow with a course on the different methods of mining in use in the district. Such subjects as piping, transportation, ventilation, sampling and pumping will be included in the series of courses."

#### *Tennessee Coal, Iron and Railroad Company Schools*

The following account of the general educational work of the Tennessee Coal, Iron and Railroad Company has been prepared by the superintendent of Schools of that Company and is published through the courtesy of the officials of the Tennessee Company.

"For quite a number of years the Tennessee Coal, Iron and Railroad Company has been assisting in a general way the educational work at its various operating plants. This assistance has been given in the form of direct appropriations in aiding the construction of school buildings, and at times the Company has assumed all the expense of constructing suitable buildings for carrying on the educational work. At a number of points, the salaries of the teachers, as paid by the public school funds, have been largely supplemented in order to secure stronger and more efficient teachers. All this work was done in conjunction with the public school authorities.

"Beginning with the present year (1913), it has been the purpose of the Company to make more efficient the school work in the various communities in which it is interested, and in order to do this, an Educational Department has been organized, with a Superintendent in charge, whose duty it is to direct the work in connection with the schools in such a way as to bring about greater efficiency than has been possible without definite and trained supervision. All this work is being done with the consent and hearty cooperation of the public school authorities. Through the Educational Department efforts are being made to have the schools stand for the very best ideals of modern educational work, and to interest the communities in this work through Mother's Clubs, Lyceum Courses and similar organizations. But perhaps the greatest benefit at present noticeable is in the improvement in the schools, and a corresponding increase in efficiency on the part of the teachers who have charge of these schools.

"All new buildings erected have been constructed so as to meet the requirements of present day school architecture, and the equipment pur-



TENNESSEE COAL COMPANY SCHOOL

chased for both old and new buildings has been selected with the idea of bringing to school's the results of modern improvements along these lines. Sanitary water closets, drinking fountains and suitable work rooms to meet the various needs have been provided. No means possible is spared to make the hygienic conditions of all school buildings in every way satisfactory; details of heating, lighting and cleaning receiving a large portion of the teachers' and pupils' personal attention.

"Medical inspection of all schools has been made possible through the cooperation with the Health Department. All school buildings are inspected weekly by the local physician, who lectures from time to time to the pupils on sanitation and hygiene with reference not only to the school, but to the home as well.

"Industrial training, especially those phases that are concerned with household economics and the problems of the home are receiving attention. Classes in sewing, cooking and gardening, with means of making practical these phases of work are being conducted at the various school centers in connection with, and in fact, is a part of the regular school work.

"The playground in connection with the schools is made to meet not only the needs of the school group, but the recreation requirements of the whole community. A number of playgrounds have been equipped with modern out-door apparatus, such as wading pools, sand boxes, swings, slides, horizontal bars, flying rings, etc.

"The Mechanic Arts Night School, which is conducted in connection with the Company's plants at Ensley has for its purpose the aiding of young men who are desirous of improving themselves in the various lines of work offered.

"Technical training is offered in electricity, mechanical drawing, chemistry and steam engineering. Classes are also organized in mathematics—algebra, geometry, trigonometry, etc. All technical subjects offered cover a period of two or more years.

"Academic work is also offered, which includes various courses in English and arithmetic to meet the needs of many of the students whose early education has been so limited as not to afford even the elementary training necessary for the every day duties of life. Advanced work in English is offered for those who are interested and prepared to meet the requirements for admission to the class.

"A class for foreigners is largely patronized.

"All classes meet three times weekly.

"A very important fact in connection with the night school is that it is conducted in a modern High School Building only a few blocks from the plant; thus affording ideal school surroundings for the class

work, with the opportunity of using the facts learned in solving real problems met in the tasks undertaken in connection with the operations in the mill. The various heads of the departments of the plant are giving considerable attention to the work offered in the Night School, and are using every means possible to make practical the instruction given."

*School at Quinton, Alabama.*

Throughout the United States many classes have been carried on by mine officials, school teachers, mine inspectors and others without the backing of a strong corporation and much good has been accomplished. The following is an account of such a class carried on by William Crooks of Quinton, Alabama, who describes his methods of operation as follows:

"I shall endeavor to give you an outline of our work by giving you a review of the class work. I have not had the advantage of a technical training and what I know of mining has been gained by practice, and a study of some good sound mining books, therefore my methods of teaching may appear crude.

"Two years ago Mr. C. McCormick, then superintendent at this place, now general manager at Newcastle, Alabama, spoke to me about starting a mining class. We agreed to try our hand at it and, to begin with, a black board was obtained, our class room being the local work office. As there were some men who seemed anxious to attend, we started the class with 12 men, representing all grades of mining. The task was not quite so easy as I anticipated. Doubtless you are aware that elementary education is not compulsory in Alabama, consequently 50 percent of those attending, knew little of mathematics and this not only made the work of teaching difficult, but also kept back those who were more fortunate in having a little education. The class met two nights in the week, Mondays and Fridays and after one month which was devoted to arithmetic, we tackled the subject of mining. The textbook was and is still "The Coal and Metal Miners Pocket Book." Each pupil has in addition to the textbook access to various books on Mining, such as Beard's "Mine Gases," books on ventilation and methods of working, etc.

"I shall now try and explain how I think I obtain the best results in teaching. I start the class early in the session with mine gases, each pupil is expected to learn the 'Chemical symbols,' Sp. Gr. explosive ranges, how detected, the effect on life, etc. While dealing with mine gases I usually take the class into the mine and examine them on their ability to handle a safety lamp. The lamps are discussed and as

there are always plenty of safety lamps of different makes on hand, each man can easily get acquainted with them.

"Then comes ventilation, the class by this time has progressed far enough to take up the study of mensuration and algebra, and apply these to the formulas on ventilation. With the mines at hand I take the class into the mine, and examine the pupils on ventilation. This includes fans, furnaces and other appliances used for ventilation. All our work in this line is well taken up.

"After ventilation, we take up mine pumps, stand pipes or the pressure of water syphons, etc. Then comes the study of working methods, pillar and room, longwall and board and stall. You see I am from Scotland and have worked under all these methods of getting coal, timber, pillars, etc., are discussed. Track work is taken up and all questions bearing on general mining, applied mechanics and steam. This is a brief resume of the work of the class.

"Questions are placed on the blackboard and each pupil is given a reasonable time to work out the sum, these are then corrected and graded. The session lasts from 3 to 4 months during which time 2 class examinations are held. I usually get the mine inspector for Alabama to hold these examinations.

"This year the class is much larger and the interest keeps growing. I am following the same lines as I did last year, but this year we are studying relative humidity and also the strength of ropes and the care of same."

#### LECTURE COURSES.

#### *Philadelphia and Reading Lectures.*

In 1904 W. J. Richards, Vice-President and General Manager of the Philadelphia and Reading Coal & Iron Company, inaugurated a course of lectures upon mining for the employes of his company. Six central locations were chosen throughout the Schuylkill region where the mines of the Reading Company are located and one lecture each week was given in each of these centers; the same lecturer going from place to place and giving his lecture each night in a different place. The attendance at the lectures was made up mainly of superintendents, foremen, bosses and the better grade of miners, and, while it was not compulsory, it was generally known that the company expected the men to take advantage of the opportunities offered to them free of charge, for special trains were run to the lecture centers and every effort was made to facilitate the attendance of the men. The aim of these lectures was not so much to fit the men for the state examinations, as to give them a general knowledge of mining and to make them better employees. The lecturers were mining engineers and other officials of the Reading

Company, outside specialists, and some of the teachers in mining from the colleges and universities of eastern Pennsylvania. The lecture courses extend over a period of about 18 weeks each winter. Some of the subjects of the lectures during the first year that the lectures were established are as follows: Ventilation and mine fans; first aid to injured; application of electricity to mining; preparation of anthracite; mine pumping; lubrication—proper care and application; explosives; compressed air; chemistry as applied to mining; ropes; care of mules; boilers; slide-valve engines; electricity; turbine pumps.

In addition to these lecture courses the Reading Company is installing night schools conducted along the same general lines as those operated by the Lehigh Valley Coal Company at Lost Creek and Centralia.

*Coal Mining Department, Lackawanna Railroad Co., Lectures.*

The general educational movement in connection with mining is closely connected with the "first-aid-to-the-injured" and "safety first" movements that have been so rapidly and extensively developed in the United States. While their movements are not primarily educational along technical lines, they offer many opportunities for cooperation with distinctly educational work and a first-aid squad or society is often the nucleus about which to build a mining class or institute.

The Coal Mining Department of the Lackawanna Railroad with headquarters in Scranton, Pennsylvania, in addition to assisting liberally in the financial support of the Y. M. C. A. classes, has at great expense had taken a series of underground photographs illustrating the way in which many of the accidents about mines occur and the proper way of carrying on mining operations so as to avoid accidents. Lectures illustrated with the stereopticon to show these photographs have been extensively given by representatives of the Lackawanna Company, not only before its employees, but also extensively thruout the mining regions of Pennsylvania and West Virginia in connection with the Y. M. C. A. institutes. These pictures are also used to teach English to the foreign workmen as is illustrated on pages 61 and 62, which are two pages copied from a book issued by the Lackawanna Company and distributed to all of its employes, entitled, "Mine Accidents and Their Prevention." The purpose of this book is best told in the words of its preface, and is as follows:

"The purpose of this book is two-fold: First, to make all mine-workers more familiar with safe methods of mining hard coal, in order that many of the more common accidents attendant upon this hazardous occupation may be avoided and the lives of the workmen may be preserved to the industry and to those dependent upon them.

"Second, to give a knowledge of colloquial English to the non-English speaking mine-workers in order that they may understand their orders intelligently and thus be better able to help themselves and protect their lives against the dangers of the mine.

"The plan has been to incorporate in a permanent form more than two hundred pictures which have been taken in the mines and have been used with telling effect in stereopticon lectures before immense gatherings of mining men.

"The pictures have been arranged in series. Each series shows an accident. The first part of the series shows how the accident happens and the last part shows how the accident might be avoided.

"The main principle of the lessons has been to tell the story of the pictures in a series of short, pointed sentences arranged in logical sequence so that the general flow of thought will not be broken. The plan of the Roberts' Lessons of English for Coming Americans published by the International Committee of Young Men's Christian Association, which has been used so successfully for a long time in teaching English to foreigners has been closely followed and in accordance with this scheme the verb has been given great prominence as this is considered the most difficult element of the language.

"The basic idea of these lessons, namely, the making of series of photographs to show the successive stages in the occurrence and prevention of an accident originated with R. A. Phillips, Superintendent Coal Mining Department, Delaware, Lackawanna and Western Railroad Company, and it is due to his persistent effort that it has been possible to carry to completion the present work.

"This selection of pictures was not made at random but is based on the Annual Reports of the Department of Mines of Pennsylvania. These Reports have been carefully studied and only those accidents which have been of most frequent occurrence and the most fruitful in loss of life or limb have been chosen for this work.

"These pictures have been procured with a great expenditure of money and of painstaking effort, and much time and energy have been devoted to the preparation of the lessons. Every lesson has been carefully thought thru and has been arranged with the view of making the special point to the pictures stand unmistakably in the foreground so that there may be no mistaking the particular point of mine law which covers the accident in question.

"There has been appended to the mining lessons a number of lessons on American Citizenship especially prepared for this book by W. J. Torrey, Esq., who has been closely connected with the Young Men's Christian Association work for Immigrants in Scranton, Pa.



with Drill on Shoulder Walking Under Drill Struck Wire. Miner Thrown to Ground  
Trolley Wire



Carrying Drill in Hand by Side

#### MINER CARRYING A DRILL ON HIS SHOULDER.

is walking	:	This miner is walking along the road.
there is	:	There is a trolley wire over the road.
is carrying	:	The miner is carrying a drill on his shoulder.
walks under	:	The miner walks under the trolley wire with his drill.
strikes	:	His drill strikes the trolley wire.
passes	:	The electricity passes through the drill to the man.
is shocked	:	The man is shocked.
is knocked	:	He is knocked to the ground.
hurts	:	The shock hurts the man.

is walking	:	In picture three the miner is walking under the trolley wire.
is carrying	:	He is carrying his drill in his hand by his side.
can touch	:	The drill cannot touch the wire now.
passes under	:	The miner passes under the wire safely.
does receive	:	He does not receive a shock.

How is the miner carrying the drill in the first picture? What happens in the first picture? What happens when the drill strikes the wire?

How does the miner carry the drill in the third picture? Is the man hurt? Which is the best way to carry the drill?

**DON'T CARRY A DRILL ON YOUR SHOULDER.**



Miner Preparing Cartridge With Lamp on Head



Powder Exploded



Preparing Cartridge With Lamp at a Safe Distance

### PREPARING A CARTRIDGE

#### (Wrong Way and Right Way)

- |              |   |                                                                       |
|--------------|---|-----------------------------------------------------------------------|
| has come     | : | The miner has come to the box to get his powder.                      |
| has          | : | He has his lamp on his cap.                                           |
| takes out    | : | He takes the cartridge out of the can.                                |
| prepares     | : | The miner prepares the cartridge with the lighted lamp above it.      |
| drops        | : | A spark drops from the light into the powder.                         |
| sets off     | : | The spark sets off the powder.                                        |
| goes off     | : | The cartridge goes off in the miner's hands.                          |
| is killed    | : | He is killed                                                          |
| <br>prepares | : | In the last picture the miner prepares the cartridge in the safe way. |
| came back    | : | Here the miner came back to the box.                                  |
| took         | : | He took the lamp off his cap.                                         |
| put away     | : | He put the lamp five feet away.                                       |
| prepares     | : | Now the miner prepares the cartridge.                                 |
| can fall     | : | No sparks can fall into the powder now.                               |
| is safe      | : | The miner is safe here.                                               |

Where is the lamp in the first picture? Can a spark fall into the cartridge? What happens while the miner prepares the cartridge? In the last picture where is the lamp. How far must the lamp be from the powder? Is this miner safe?

ALWAYS KEEP THE LAMP FIVE FEET FROM THE POWDER.

*Y. M. C. A. Institutes and Schools.*

The most extensive and systematic mining classes and institutes yet established in the United States are those inaugurated in the coal fields of Pennsylvania by the Young Men's Christian Association. This movement was originated and organized in both the anthracite and bituminous regions of Pennsylvania by Mr. Charles L. Fay, Secretary of the Mining Department of the Pennsylvania Y. M. C. A. and was the outgrowth of experimental work done at Oliver, Fayette County, Pennsylvania in 1904-5.

*History of the Movement.*

The following history of the movement has been furnished by Mr. Fay:

"The first step was a class formed at Oliver to study mining and this class work included the reading and discussion of papers upon mining subjects. Later on district institutes were organized to meet once each year for the reading and discussion of papers, but as the interest in the work grew, local institutes were formed within the district institutes to meet monthly.

"For organization purposes the Pennsylvania coal fields were divided into institute districts, each district being an independent unit under the general supervision of the local Y. M. C. A. of the district. In districts not having local Y. M. C. A.'s the institutes were operated under the general supervision of the State Y. M. C. A. Mining Department; it was also the distinct function of the State Y. M. C. A. to promote the institute movement wherever the conditions seemed favorable.

"By the beginning of 1908, 12 districts and several local institutes were on a good working basis in the Bituminous region, and in November, 1907 a campaign was initiated that resulted in the establishment of the movement in the anthracite field thru the organization early in 1908 of district institutes at Pittston, Wilkes-Barre and Scranton, followed the next few years by a large number of institutes thruout the anthracite field. As the movement grew the district institutes became stronger and self-supporting. The separation into local and district institutes was discontinued, and the district organization then performed the duties pertaining to both the district and local institutes. A definite move was also made to have the coal companies assume the leadership and responsibility."

Since Mr. Fay gave up Y. M. C. A. work in 1912 it has not seemed necessary for the State Y. M. C. A. to continue the general oversight of all the institutes necessary in the formation period. Many

of them are now self-sustaining, and, moreover, the coal companies realizing the importance of the movement have become more directly and officially interested than formerly when their interest consisted mainly in financial contributions. Many of the coal companies have made the educational work a distinct department of the company organization, particularly in the smaller towns, where all of the mines are under one company organization. In the larger towns, such as Scranton, and Wilkes-Barre the companies co-operate with the institutes carried on by the Y. M. C. A. The following details in regard to the anthracite institute movement as carried on at present are based upon a personal inspection of the work, upon data furnished by officials of coal companies, by Mr. Fay and other Y. M. C. A. workers and upon a very interesting pamphlet, entitled, "Mining Institutes and Vocational Schools" prepared for the Susquehanna Coal Company, Wilkes-Barre, Pennsylvania, by Mr. Charles K. Glooman, Chief Clerk, to stimulate and encourage the further organization and development of the institutes and night schools among the employees of the Susquehanna Coal Company and its neighbors.

A District Institute operates under a regular constitution and by-laws, and the appended constitution appearing in Mr. Glooman's paper shows the scope and method of carrying on the work in the anthracite region of Pennsylvania.

(EXHIBIT A.)

Constitution and By-Laws of the.....District Mining  
Institute.

PREAMBLE.

Whereas: We, who are engaged and interested in the vocation and profession of Mining in the.....District, believing that we can promote the interest and welfare of the men employed in this great industry, also the industry itself, therefore unite in an association to be known as the.....District Mining Institute" and adopt the following articles of association:

Adopted.....

CONSTITUTION.

ARTICLE I.

1. This Institute is held under the auspices of the Mining Department and its objects are such as are stated in the Preamble.

2. Any person engaged or interested in mining shall be eligible to membership and shall be entitled to all the rights of membership so long as he complies with the regulations of the Constitution; but no one shall be entitled to hold office until he has paid all dues in full to date.

ARTICLE II.

1. The officers of the Institute shall be a President, a Vice President, Secretary and Treasurer.

2. It shall be the duty of the President to preside at all meetings of the Institute; to call special meetings of the Institute at the written request of five members or whenever he shall deem it desirable to do so; to sign all official communications coming from the institute and to represent the Institute on public occasions not otherwise provided for; he shall also be President of the Board of Directors.

3. The Vice President of the Institute shall, in the absence of the President, preside over the meeting of the Institute, and in the event of his resignation or death, succeed to the duties of the President's office until his successor is duly elected.

4. If desirable, the Board of Directors shall elect one person to fill the offices of Secretary and Treasurer.

5. The Secretary shall keep a record of each meeting, and shall read the minutes when so requested by the Chairman. He must read and file all resolutions and papers which may come before the body and allow none to go from his custody without due authority. He shall countersign all orders for money which have been signed by the President. He shall order necessary supplies when so directed by vote of the Board of Directors. He shall issue the call for meetings, notify officers and members of their election and committees of their appointment. He shall keep a correct list of all the members of the Institute, with their place of residence and occupations; also collect dues and assessments and pay them over to the Treasurer. He shall turn over all the books, records and papers in good order, to his successor at the expiration of his term as Secretary.

6. The duties of the Treasurer shall be to keep a record of all the monies received by him and payments made on account of this Institute. He must pay out no money except on an order signed by the President and countersigned by the Secretary. He shall retain these orders as his vouchers, and if this Institute so requires, he shall give bond in such needful sum as it may deem best. He shall turn over all money due this Institute and his books in good order, to his successor at the expiration of his term as Treasurer.

### ARTICLE III.

1. All meetings of the Institute shall be held in the Borough of

2. The meetings of the Institute shall be held monthly on the first Thursday, omitting June, July, August and September.

3. The annual meeting of the Institute shall be held in the month of ..... or may be held at such time as may be named by the President of the Institute in his call for a meeting. The order of business for the annual meeting shall be prescribed by the By-Laws of the Institute.

### ARTICLE IV.

#### Board of Directors.

1. A Board of Directors shall be elected upon organizing.

2. The Board of Directors shall, at its first regular meeting following their election, choose by ballot, from its number, a President, a Vice President, Secretary and Treasurer, who shall be the officers of the Institute and of the Board, and shall hold office for one year, or until their successors shall have been elected.

3. The Board of Directors shall have power to fill all vacancies occurring from any cause in any of the offices, including that of Director.

## ARTICLE V.

1. Meetings of the Board of Directors shall be held at such times as the President of the Board may appoint.
2. At any meeting of the Board of Directors five shall constitute a quorum for the transaction of business.

## ARTICLE VI.

1. The Board of Directors shall have power to decide as to the acceptance and publication of any professional papers presented to the Institute.
2. The copyright of all professional papers communicated to and accepted by the Institute shall be vested in the Institute unless otherwise expressly agreed upon by the Board of Directors and the author. The Institute shall not assume any responsibility for any statements of fact or opinion advanced in the papers or discussions at its meetings. Neither the Board of Directors nor the Institute shall officially approve or disapprove any technical or scientific opinion or any proposed enterprise outside of the management of the meeting, discussions and publications of the Institute and the conduct of its business affairs by the Board of Directors.
3. Immediately after his election the President shall appoint the following standing committees, to consist of five members each, namely: Educational, Social, and Auditing. Special committees may from time to time be appointed by the President to make investigations and prepare reports for presentation to the Institute but no action shall be taken binding the Institute for, or against, the conclusions embodied in any such reports.

## Educational Committee.

4. The duties of the Educational Committee shall be to arrange suitable programs, secure lecturers and act for the monthly meeting of the Institute. This committee shall form classes and arrange suitable class schedules, secure teachers and execute such other duties of like nature as the Institute may direct.

## Social Committee.

5. The Social Committee shall arrange for and have charge of any social functions or entertainments held under the auspices of this Institute, and shall assist the Educational Committee by arranging for social features at the monthly meetings. This committee shall at all times endeavor to promote a spirit of good fellowship among the members, and shall give especial attention to new members, to see that they are properly welcomed and made acquainted with all the members of the Institute.

## Auditing Committee.

6. The President shall appoint an Auditing Committee annually, to properly audit the accounts of the Secretary and Treasurer, to be submitted at the annual meeting of the Institute.

## ARTICLE VII.

1. No paper, debate or discussion of a political or sectarian nature shall be permitted in any meeting of the Institute.
2. The use of profanity in any meeting of this Institute is forbidden. Intoxicating beverages must not be brought into any meeting of the Institute, nor served at any banquets or socials given under the auspices of this Institute.

## ARTICLE VIII.

1. Membership shall be One Dollar (\$1.00) per annum, payable in advance, and will expire at the end of April of each year.

### ARTICLE IX.

1. This Constitution may be altered or amended at the annual meeting, by a two-thirds vote of the members present; provided, notice has been given at a previous meeting of said proposed change, alteration or amendment.

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### BY-LAWS.

#### ARTICLE I.

1. At all meetings of the Institute the officers as prescribed in Article II, Section 2, shall preside. In the absence of all such officers any other members of the Board of Directors chosen by the meeting, shall preside.

#### ARTICLE II.

1. At each meeting of the Board of Directors the order of business shall be as follows:

- a. Reading of minutes of preceding meeting.
- b. Report of President.
- c. Report of Secretary.
- d. Report of Treasurer.
- e. Report of Standing Committees.
- f. Report of Special Committees.
- g. Special Business.
- h. Miscellaneous.

This order of business may be changed by a vote of the majority of the members present. The usual parliamentary rules shall govern all meetings of the Institute. At all sessions of the Institute the order of proceedings and the time of adjournment shall rest in the discretion of the presiding officer.

#### ARTICLE III.

##### Committee on Membership.

1. All nominations for membership in the Institute shall be submitted to and passed upon by the Board of Directors.

The courses of instruction laid out for the night classes carried on in Wilkes-Barre and Scranton are as follows:

#### *Wilkes-Barre Mining School.*

This school is conducted jointly by the Wilkes-Barre Y. M. C. A. and the Wilkes-Barre District Mining Institute. The session continues from about October 10th to about April 9th, that is, six months.

The course is as follows: the number in parenthesis after each subject denoting the number of 40-minute periods each week devoted to the subject.

#### FIRST YEAR.

##### *Arithmetic.*

From addition to decimals. Particular attention to reduction and conversion. (4)

##### *Mine Gases.*

Occurrence, properties, behavior and detection. (3)

##### *Mine ventilation.*

General principles of mine ventilation. Production and control of air currents. (2)

##### *Mine Law.*

Anthracite mining laws of Pennsylvania. Application and practical reference. (1)

## SECOND YEAR.

*Arithmetic.*

Decimals, percentage, mensuration, involution and evolution, ratio and proportion. Trigonometry. Logarithms. (2)

*Mine surveying.*

General principles of surveying. Compass surveying and instruments.

General principles of mapping. Linear and angular measurements. (1)

*Mine ventilation.*

Production and control of air currents. Practical considerations in regulating and splitting. Ventilators. (1)

*Electricity and magnetism:*

Fundamental principles. (1)

*Mechanics.*

Matter, motion and velocity, force, pulleys and gears, friction, centrifugal force, work and energy. (1)

*Air compression.*

General principles and transmission. (1)

*Mine law.*

Anthracite mining laws of Pennsylvania. (1)

*General.*

Elementary—Timbering, haulage and pumping. (1)

## THIRD YEAR.

*Mine ventilation.*

Calculation and analyses of ventilation and ventilators. (1)

*Mechanics.*

Force, work and energy, composition and resolution of forces, strength of materials. (1)

*Mine surveying.*

Calculations, notes, mapping, logarithms. (1)

*Electricity and magnetism.*

Conductors, batteries, circuits, electrical units, application, (1)

*Air compression.*

Compressors, transmission and application. (1)

*Mine law.*

Application and practical reference. (1)

*General.*

Timbering, track work, hoisting, haulage, pumping, drainage, steam and steam boilers, preparation of anthracite. (1)

The classes meet two nights per week (Tuesday and Friday) and the class periods are held each night (7:30 to 8:10), (8:10 to 8:50), and (8:50 to 9:30).

The fee for the course is \$8.00 per year, but to all who complete the full three-year course and pass a satisfactory examination, the fees are refunded. This remission of fees is made possible by the generosity of some of the coal company managers, who are interested in the school.

The books used are loaned to the students by the school, upon the payment of a fee, which is returned when the book is returned.

The teachers in the school are all connected with the coal companies having headquarters in and about Wilkes-Barre. The enrollment at the school has been as follows:

	Enrollment
1912-1913 .....	64
1913-1914 .....	73

This school is a direct outgrowth and continuation of the night classes in mining carried on very successfully by the Wilkes-Barre Y. M. C. A. for some years past, but a decided stimulus has been given the work by cooperation with the District Mining Institutes.

#### *Scranton Institute and School.*

The Scranton Y. M. C. A. and Y. M. C. A.'s in other towns in Pennsylvania conduct a school in cooperation with a District Mining Institute along lines very similar to those already described for Wilkes-Barre.

In Scranton the Mining Course includes according to the printed circulars:

*Mathematics:* practical arithmetic, ratio and proportion, geometry of plane figures, simple equations, plane trigonometry, mensuration.

*Chemistry:* principles of elementary chemistry, mine gases studied with reference to combustion.

*Physics:* lectures, demonstrated.

*Mining:* mine gases, friction of air in mines, fan ventilation, manner of making efficiency tests, natural and furnace ventilation, ventilation of splits, practice with the instruments used in experimenting in ventilation, safety lamps, description of the principal ones, discussion of their relative merits. Removing of explosive gases. Explosions. Remedies, etc. Mine fires, dams and drainage, pumps, etc. Mining systems. Timbering and pillars, with problems. Mine law. Principles of surveying and mapping. Practical mining lectures. Development of coal mines.

#### EVENING CLASSES FOR FOREIGNERS.

- (a) Beginners' class in English and accident prevention.
- (b) Advanced class in English, civics, geography and history.

#### CLASS SCHEDULE.

Mining—Tuesday and Friday evenings, 7:30 to 9:30; Fee, \$12.

English (a) for Foreigners—Monday, Wednesday and Friday evenings, 7:30 to 9:30; Fee, \$3.75.

English (b) for Foreigners—Tuesday and Thursday evenings, 7:30 to 9:30; Fee, \$3.25.

Arithmetic for Foreigners—Wednesday evenings, 7:30 to 9:30; Fee, \$4.

These fees are in addition to Association membership dues, \$3.00 yearly.

The year is divided into 2 terms.

First: October 1 to December 15.

Second: January 1 to March 15.

The composition of the Board of Directors of the Scranton District Mining Institute includes the following representatives of the several companies having their headquarters in the city:

President, Asst. Supt., D. L. & W. Co.  
Sec. and Treas., State Mine Inspector.  
Asst. Secretary, Foreman, D. L. & W. Co.  
Vice-President, Foreman, Pennsylvania Coal Co.  
Vice-President, District Superintendent, D. L. & W. Co.  
Vice-President, Dist. Supt., Scranton Coal Co.  
Vice-President, Dist. Supt., D. & H. Co.  
Vice-President, Dist. Supt., D. & H. Co.  
Vice-President, Dist. Supt., D. L. & W. Co.  
Miner, D. L. & W. Co.  
Foreman, D. & H. Co.  
2 Miners, D. L. & W. Co.  
Foreman, D. & H. Co.  
Miner, Pennsylvania Coal Co.  
Coal Inspector, Pennsylvania Coal Co.  
4 Miners, D. & H. Co.  
Foreman, Scranton Coal Co.  
Miner, Scranton Coal Co.

A sample of one of the District Institute programs is as follows:  
1:30 Business session—Election of Officers.  
2:30 Address by Chairman.  
3:00 Paper—Explosive and Non-Explosive Gases in Coal Mines and Causes of Their Accumulation.  
4:00 Paper—Prevention of Accidents in and Around Mines.  
5:00 Recess.  
5:30 to 7:30 Institute supper and social hour.  
7:30 Question Box.  
8:30 Paper—How May We Best Instruct Foreign-Speaking Men to Become Efficient Miners?  
9:30 Closing Address.

Each paper will be followed by a General Discussion:

The annual banquets of some of these institutes are notable gatherings, and it can be readily understood that the social feature is not the least of the educational profits derived from such a movement when frequently 500 to 700 men sit down at the same board, representing all grades in rank, from the President of the Company to the young trapper boy.

The gradual development of a systematic educational movement by the Susquehanna Coal Company is described by Mr. Gloman as follows:

*Public Night Schools for Anthracite Mine Workers, Pennsylvania.*

"For ten years prior to 1910 the Susquehanna Coal Company contributed \$1,000.00 annually to the Headquarters of the Anthracite

Region Committee Y. M. C. A. of Pennsylvania to aid in its endeavors to improve the conditions among mine workers. Mr. Morris Williams, President of the Susquehanna Coal Company, was induced to become chairman of the committee while he was Manager of the Company; he was succeeded by Captain W. A. May, then Manager, now President of the Pennsylvania Coal Company, and Hillside Coal & Iron Company, whose company was also one of the generous contributors. Mr. Robert A. Quin, upon becoming Manager of the Susquehanna Coal Company, interested himself and continued the Company's support. These officials and the district superintendents and local officers contributed from their personal funds also. The present representative of the Susquehanna Coal Company was the recording secretary and a member of the executive committee.

"Various plans were promulgated by the committee. The first—the volunteer workers' plan, under which local associations were opened and named by volunteers, as workers and contributors, in which local officials and employees of the Susquehanna Coal Company were joined by those of other companies. This plan did not meet all of the needs and conditions for small mining communities in a satisfactory way. In 1907, under the administration of the new secretary of the committee, Mr. C. L. Fay, who came from the State Bituminous Region, Y. M. C. A., the plan of organization and development of the Mining Institute, a form of Lyceum with monthly meetings, reading mining papers, talks on mining subjects and discussions was inaugurated in some of the larger centers and a few smaller towns. These thrived best, however, in the former places, where there were to be found many more officers and working men of influence, and suitable quarters for its meetings. From the nature of the case, as the number of organizations increased the financial support formerly going to the headquarters of the Anthracite Region Committee was turned into local work, and eventually on that account the headquarters were merged into the State Y. M. C. A. at Harrisburg.

"In the Fall of 1910, the Susquehanna Coal Company took definite steps to inaugurate the opening of night schools for its employees in the Nanticoke and Shamokin districts, and deemed it advisable to foster the "Mining Institute" plan for the purpose. Organizations were formed with General Inside Foreman, Mr. John T. Thomas, President, at Nanticoke; and General Inside Foreman, Mr. Richard J. Holland, President, at Shamokin; and night schools were started by both Institutes. A small tuition fee was charged. At Nanticoke the Company paid the salary of the Institute Secretary and three teachers, the other teachers serving gratis. At Shamokin the Institute

paid all expenses with some assistance from the Mineral Railroad & Mining Company, a subsidiary of the Susquehanna Coal Co.

"In October, 1911, both Institutes resumed work for the second term with increasing members and larger banquets. The banquet being one of the \$1.00 membership privileges. The schools resumed sessions under the same plan as the previous year, except that in the Shamokin district the Institute employed as instructors, Cyrus Williston at Shamokin, and Professor Rodebush at Mount Carmel.

"Dr. N. C. Schaefer, State Superintendent of Public Instruction, was invited to the opening Nanticoke Institute October 11, 1911, and stated on that occasion that "Under the new law School Boards had full authority to conduct mining schools, and classes in English, up to the extent of the demands of the citizens and their willingness to provide funds."

"In order further to show the employees who were members of these Institutes that their employers were interested in aiding them to help themselves, representatives of the Susquehanna Coal Company asked for and secured in the Nanticoke district the financial cooperation of the Delaware, Lackawanna & Western Railroad Company, and the Lehigh & Wilkes-Barre Coal Company, which has been continued ever since; and in the Shamokin district of the Lehigh Valley Coal Company for the year.

"In 1910 and 1911 the various school boards gave free use of the school building wherever the privilege was asked for.

"In the summer of 1912, petitions were presented thru the Mining Institutes to every school board in the districts, asking them to provide night schools in the Fall for mining men and boys, at the expense of the School District, as provided in the new school code. This was cheerfully done in all cases, and the growth is shown in the summary below. Mr. M. B. King, Expert Assistant in Industrial Education, Department of Public Instruction, was invited to study the movement from the beginning of the term. The Institutes employed a field secretary one week each month thruout the term, who visited the schools and prepared schedules of visitors to the classes, and monthly reports of students, sending same to the mine foremen, officials and school authorities. The various school boards issued certificates of progress and grading to the night school students at the end of the term in the spring of 1913.

"In 1913 the State Legislature having enacted the "Vocational Educational" bill, and made an appropriation providing State aid, gave much encouragement to these Mining Institutes and the local school boards, resulting in a large enrollment in the Night Schools in October.

The membership in the Institutes also increased. Many of the problems regarding teaching, supervision and text-books, are being solved by the combined interest and cooperation of the Mining Institutes, the School Boards, the citizens, the Coal Companies and the Department of Public Instruction. Advisory committees for the schools are appointed by the School Boards, and these are generally taken from the Institute membership.

"The Susquehanna Coal Company, the Delaware, Lackawanna & Western Railroad Company and the Lehigh & Wilkes-Barre Coal Company have continued to guarantee the financing of the Nanticoke Mining Institute.

"The Mineral Railroad & Mining Company, which is allied with the Susquehanna Coal Company, is this year assisted by the Philadelphia & Reading Coal & Iron Company in the guarantee to the Shamokin-Mt. Carmel District Mining Institute. The Williams Valley District Mining Institute has just been organized in Lykens and Williams-town, Dauphin County, among the employees of the Summit Branch Mining Company, which is a subsidiary of the Susquehanna Coal Company, and schools are about ready to begin.

"This plan of conducting evening schools appears to have solved the practicability and feasibility of providing in mining communities, regardless of their location, size and population, available and convenient organized equipment, methods and supervision thru the State Public School system, augmented by the backing and initiative of the influential Mining Institutes made up of the active mine employees and their officials. The school authorities value the assistance of the Mining Institutes and vice versa. The scheme is of such flexibility that while holding all the ground of the past term, it can be supplemented readily.

"While any person at work in the day time is eligible as a student these classes are composed of over 90% of mine employees from practically all of the numerous occupations connected with anthracite mining, whether on the surface or underground. The studies range all the way from elementary branches for the youth and for the adults who lacked previous opportunity for an education, up to the advanced work for fitting a person for the requirements of a thorough technical knowledge of the art of mining, whose problems are increasing as mining goes deeper and presents additional and serious conditions. There are also classes for the non-English speaking employees, many of whom after getting the language enter the other classes.

"The evening schools are also providing instruction in a similar way in Domestic Science to the wives and daughters of the many

mine workers and others. This is a direct asset to the mining communities, and while the Mining Institutes include these in their surveillance, the figures of these classes are omitted from the summary of students given below.

The Mining Institutes vary their monthly programs so as to interest eventually during the term the employees whatever their occupation, frequently having illustrated talks on mining and other outside educational subjects. The largest halls in the communities are necessary for the purpose. Occasionally illustrated programs are repeated for the benefit of the Day Schools in the community. The Annual Banquets at the beginning of each term frequently surpass the limits of the largest assembly room available, and the speakers represent many of the large coal company officials and citizens.

"Students of these night schools have been able by their studies in these schools to qualify for certificates before the State Boards for Mine Foremen examinations as follows:

	At Nanticoke	At Shamokin
1911 .....	7	5
1912 .....	No Examination	5
1913 .....	28	8

"The following summary will indicate the remarkable growth of the Mining Institutes, and of the increased enrollment of night school students under the plan outlined, in the districts where the Susquehanna Coal Company conducts mining operations:"

	Nanticoke District			Shamokin-Mt. Carmel District		Lykens District
	Mining Institute	Nanticoke Boro. Schools	Newport Township Schools	Mining Institute	4 School District Schools	
		Mining Institute	Mining Institute		Mining Institute	
Dec. 1, 1910.....	50	80	28	108	100	
Dec. 1, 1911.....	500	98	30	254	128	
Dec. 1, 1912.....	679	285	372	571	763	
Dec. 1, 1913.....	815	420	374	760	*526	300

\*Note—Some additional classes are yet to enroll in Shamokin-Mt.Carmel District; also Lykens District.

### Bituminous Region of Pennsylvania.

The institute movement in the Bituminous region of Pennsylvania has developed along lines very similar to those adopted in the anthracite region. The work was instituted and has been carried on mainly in connection with the Y. M. C. A. cooperating with the coal operators and under the leadership, first, of C. L. Fay, and later of T. B. Dilts and Ira D. Shaw of the Pennsylvania Bituminous Y. M. C. A. Mining Committee. So similar is the movement to that in the anthracite field that a detailed description is unnecessary.

*Y. M. C. A. Institutes in West Virginia.*

The Y. M. C. A. movement has not been confined to Pennsylvania, but has started in Ohio and West Virginia under Mr. Ira D. Shaw, whose headquarters are the Central Y. M. C. A., Pittsburg, Pa., and who says in regard to the work in West Virginia:

"In West Virginia we have classes meeting once per week. The class is led by some competent man in the employ of the company, usually one who has had university training. At Decota we used the chief engineer, who is a graduate of Edinburgh. We also use foremen and superintendents in whom the men have confidence. It has proven wise to use the men as much as possible to prepare papers and have them discussed in the meetings. This use of the miner himself gets him to see things he would otherwise ignore. West Virginia presents some difficulties in the way of getting incentives to induce men to enter classes. There is no legal standard for a miner and the only inducement for the miner to study at present is to pass the state examinations necessary to the promotion to the position of boss or foreman. My plan for the state mining work is to have classes located at convenient points near the different operations. Several of these centers will be combined into a district, having a meeting once in three months. These meetings will be addressed by practical men with a high training in mining. The districts will head up in the State Mining Institute which now meets twice per year. In West Virginia there are to be at least six districts with from four to seventeen class centers in each district.

"In my work I have used the stereopticon and slides illustrating right and wrong methods of the miner. The slides are a series made by The Delaware & Lackawanna Co. which, according to their own statement, show how ninety per cent of their accidents happen. I have often heard the miners in looking at the pictures make such remarks as 'That is how such a one lost his leg', or 'That is the way John Smith was killed.' These pictures never fail to make an impression.

"The State University is now in position to cooperate with the local work better than formerly and we are looking forward to the larger use of this agency.

"The classes at Decota were made famous by the fact that every one of the members of it who took the state examinations was able to pass with credit."

*State Assistance to Mining Classes in Pennsylvania.*

In Pennsylvania where the mining institutes and classes have thus far reached the greatest development, the trend seems to be away from the local management of the Y. M. C. A. toward inclusion in the recognized educational system of the State.

By an Act signed by the Governor of Pennsylvania May 1, 1913, the State Board of Education is authorized and directed to investigate and to aid in the introduction of industrial, agricultural and household arts education, and any school district may thru its Board of Directors establish and maintain industrial, agricultural and household art schools or departments. Financial assistance is given by the State in carrying on this work. This movement seems to have had its inspiration in the mining institutes and schools carried on in the mining districts of the State. The Pennsylvania Department of Public Instruction has issued a bulletin entitled, "Evening Classes in Industrial Education," which describes the methods of putting this Act into effect. Mr. M. B. King, expert assistant in Industrial Education of the Bureau of Education, writes as follows in regard to the proposed mining institute work:

"We have attacked the problem of educating mine workers. Last year there were twelve schools conducted by the several school districts in the anthracite regions. These schools were conducted without any aid whatever from the State and we think very good results were obtained, in view of the fact that such work had never before been attempted by the public schools of the State. Instruction was given in mine gases, mine ventilation, mining law adapted to the needs of the miner, and elementary English. This coming winter we hope to open a larger number of schools and extend the work so as to include the instruction suitable to the driver boy, machinist, pump runner, boiler fireman, engineer and women.

"This work is entirely new. In fact it is an experiment on the part of the public schools and we are going slowly. As you know there are no texts written suitable for this type of schools. We hope to have our practical men get up the lessons and we will send them out to the various teachers in mimeograph sheets. After we have tried out these courses and are reasonably sure that they are the things we need they will be placed in print for distribution.

"A great many of the large coal companies are greatly interested in this movement and are giving it their hearty support. The men themselves are becoming enthusiastic and have organized mining institutes in quite a number of places in the anthracite regions.

"These institutes meet once a month and papers are written by the workmen on some particular phase on his day's job are read. Last year over one thousand mine workers sat down at a regular Institute Banquet. I mention this merely to show you the manner in which this new movement has been received by the various persons interested."

Under the heading "Course of Study" Bulletin 3 on Evening Classes in Industrial Education says:

The course of study for the evening class in industrial education will be approved when it meets the following conditions:

(1) It should give training for the trades and industries dominant in the community.

(2) It should prepare the pupil to meet the demands of the trade or occupation he is following.

(3) It should be based upon the advice and experience of an advisory committee representing the various trades and industries for which the class gives helpful instruction.

(4) At least three-fourths of the time should be devoted to vocational subjects.

(5) The course of study should be composed of a series of short unit courses.

A plan of a course of study made up of a series of unit courses is given below. This plan pre-supposes that the class be kept open eighty nights of two hours each or one hundred and sixty hours in all. The term is divided into four parts of twenty evenings each and each evening into four thirty-minute periods.

#### MINING CLASS

Period	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
1st,.....	English	English	English	English
2nd,.....	Mining Law	Mining Law	Mining Law	Mining Law
3rd,.....	Mining Arithmetic	Mining Arithmetic	Mining Arithmetic	Mining Arithmetic Surveying
4th, .....	Mine Ventilation	Mining Gases	Charge Firing Explosives	Timbering Dainage Haulage

Experience has demonstrated that the productive wage earner can be dealt with successfully by short unit courses which meet his next need as a workman and give him his next step forward. The unit course has no fixed length. A course may be one hour, ten hours or fifty hours in length. An organization of short unit courses makes it possible for a worker to come into the evening class, take one or more courses he needs and depart without interfering with the organization of the school.

#### *Ellsworth-Cokeburg Night School.*

One of the first schools organized in the bituminous region of Pennsylvania under the Vocational School Act was the Ellsworth-Cokeburg Night School under the direction of Mr. E. E. Bach, Superintendent of the Sociological Department of the Ellsworth Collieries Company. Mr. Bach has planned a comprehensive group of evening classes which he describes as follows:

In order to afford all persons, above the age of fourteen (14) years of age, an opportunity of self improvement, this night school has been established by the School Boards of Ellsworth and Cokeburg.

If the classes have an average attendance of at least fifteen (15) members the tuition will be FREE.

1—*The course in coal mining and allied subjects*, is intended for students who desire to take the examinations for mine foreman and fire boss.

2—*The course in household arts*, is intended for girls who have left school and for foreign speaking women, who desire instruction in cooking, sewing, laundering and household accounting.

3—*The course in English for foreign speaking Americans*, is designed for foreign speaking Americans who desire to learn to read and write English in order that they may better understand their work in the mines.

4—*The course in mine safety* has for its purpose the conservation of human life in and about the mine.

5—*The mechanical drawing* is such as can be correlated with the other courses, in line with mining occupations.

*The courses are arranged in a unit system*, in order to offer persons an opportunity of taking the specific work which they desire. The courses have been arranged in a series covering a total of ten (10) units to a course.

For example: Those who desire to prepare for fire boss examination need only to take the third unit on mine gases during December, and the elementary courses during the rest of the time. Any student may enter any course at any time providing he begins the work of any regular course.

#### CORRESPONDENCE INSTRUCTION.

The passage of the Pennsylvania mine law of 1885 not only created a general demand for secondary mining education in the

United States, but this law was also the cause of the beginning of technical instruction by correspondence in America. T. J. Foster, who had for some years prior to 1885 been editor of the *Mining Herald* in Shenandoah, Pa., was very active in having an educational requirement incorporated into the law of 1885. In the *Mining Herald* he had for years printed technical articles upon mining by such well-known engineers as C. M. Percy of England, and others. These articles were intended to assist the ambitious and studious men about the mines, and after the passage of the law of 1885 they were especially designed for those wishing to fit themselves to pass the State examinations. In 1887 the *Mining Herald*, which had been previously a weekly newspaper with a technical mining department, was changed to the *Colliery Engineer*, a distinctly technical mining publication, and in 1888 the headquarters were moved to Scranton, Pa. Men preparing themselves for State examinations were urged to ask questions or to answer such questions as were asked by others upon subjects pertaining to mining, the questions and answers being published each month in the *Colliery Engineer*. This feature of the paper immediately became so popular that it was apparent that this medium alone could not supply the instruction and assistance needed in connection with the State mining examinations. Consequently, in August, 1891, the *Colliery Engineer* Company began the preparation of leaflets for the use of men studying to pass the examinations for foreman, assistant foreman and fire boss. The subjects of these leaflets were mine surveying, mine gases, ventilation, mining methods, mine machinery, etc. Since October 16, 1891, when the first student enrolled in mining by correspondence, over 46,500 persons have taken up correspondence mining courses in the International Correspondence Schools alone. These men are about equally divided between coal and ore mining and are scattered through every country in the world, large numbers especially being found in South Africa, Australia and the other English colonies.

As to the results of correspondence instruction, the writer will quote from others. In connection with a paper upon "The Value of Correspondence Instruction to the Mining Man," read before the American Mining Congress held in Joplin, Mo., in November, 1907, over one hundred letters were sent to prominent mining men thruout the United States and Canada asking for answers to certain questions submitted to them. Two of these questions, especially applicable to the present discussion, were as follows:

- (1) What is your opinion of the value of correspondence in-

struction to others with whom you have come in contact as regards their efficiency about the mines?

(2) In the State examinations, how do students of mining by correspondence compare with other applicants who have not taken correspondence courses?

It is difficult to tabulate answers received to question (1) since the opinions are expressed in such different terms. Fifteen answered simply that they have the highest opinion of such instruction. A large number of others say that men who have taken such courses are more reliable, have more fixety of purpose, are more ambitious, take a greater interest in the affairs of the company, give their superiors less trouble, are up to date in their methods, and that men with such instruction are much above the average of their fellow workmen. One Chief of Department of Mines writes: "It has brought about greater efficiency among mine managers, it brings young men to the front who would otherwise remain working at the face, and enables the older men to keep up with the times and with the advancement in mining life."

The replies to question (2) stated without exception that students of mining by correspondence lead those who had prepared by themselves for such examinations, and that they give better answers and show greater reasoning power. A member of an examining board from British Columbia states that correspondence students stand foremost in the examinations in that section.

Correspondence instruction offers a successful means of obtaining a technical knowledge of mining to many men who have no other way of obtaining such a knowledge. It has been tried out successfully in America, in England, in South Africa, and in Australia under varying conditions and must be considered henceforth in connection with any general educational scheme.

General instruction by correspondence has been carried on by a number of educational institutions, the most notable examples being Chicago University and the University of Wisconsin, while many of the agricultural colleges are using the system widely. There are also private enterprises for giving such instruction in all manner of subjects. The Western Mining School of Mining Engineering in St. Louis, Missouri, aims to prepare men for state examinations in coal mining states.

## INDUSTRIAL MINING EDUCATION IN FOREIGN COUNTRIES.

### NOVA SCOTIA.

The most comprehensive system of industrial mining schools existing in America at present under governmental auspices is that in Nova Scotia. For the following account of the system the author is indebted to personal correspondence with and to the published reports and papers noted elsewhere of Frederick A. Sexton, Director of Technical Education of Nova Scotia, supplemented by a personal inspection of the work under the direction of Mr. Sexton.

Almost simultaneously with Pennsylvania, Nova Scotia passed a law requiring certificates of competency for colliery officials and in 1888 the provincial government established a system of evening technical schools for coal miners. The instructors were mine officials, who were paid according to the number of their pupils who were successful at the examinations. The total expense was borne by the Provincial Treasury. The students paid no fees. The instruction covered the subjects necessary for the examinations of overmen and underground managers. These schools did a pioneer work of the greatest importance and after the schools started practically all of the colliery officials in Nova Scotia obtained their certificates thru the medium of the evening classes.

A few years later when the Province required that all hoisting engineers at collieries should also have certificates of competency as stationery engineers, evening technical classes were established and maintained by the government for the benefit of the men desiring engineer's certificates.

In 1906 when the Provincial Legislature passed an act establishing a comprehensive system of technical education for the whole of Nova Scotia, the technical schools already established became a part to the new department thus created, and these schools were at once thoroly reorganized and put on a sound educational basis. The school term was increased from six weeks to eight weeks and a preparatory class in mathematics and English composition was introduced into every coal mining community in the province, because the elementary education of many of the students in the technical schools was found to

be so deficient that they could not take full advantage of the instruction offered.

These preparatory classes are now held in each locality where coal mining or engineering schools are conducted whenever ten or more applicants apply for such a school to fit them for entrance to the higher classes.

Three types of secondary technical schools are now being carried on in Nova Scotia.

(1) Coal mining schools that are especially intended for coal miners and coal mining officials who wish to acquire a greater knowledge of the science and art of coal mining, and for those who wish to procure the Government certificates of competency for manager, underground manager or overman.

(2) Engineering schools that offer to ambitious young men who operate the machinery around the different collieries a chance to acquire a more complete knowledge of the principles of steam and mechanical engineering and provide instruction for those who are working for first, second, or third class certificates of competency as stationary engineers.

(3) Technical schools where artisans or people who are engaged in commercial life are given evening instruction in the mathematics, English, bookkeeping, science, drawing or needlework which appertain especially to their vocations. These also include special classes in chemistry for workers in metallurgical and industrial chemical plants.

The coal mining schools and the engineering schools have preparatory classes in common.

It has been found necessary to open special classes in mechanical drawing and electricity in some of the larger colliery centers. These classes have been formed in response to a demand for such subjects because they are a necessary part of the knowledge of the colliery manager and engineer at this time when many collieries are being electrified, and when much installation, construction, and repair work are done from drawings.

The courses given in the coal mining and engineering schools include the following subjects:

*Modes of working*—Sinking, methods of mining coal, supporting excavations, haulage, pumping, winding and surface arrangements.

*Ventilation*—theory, practice, lighting and dealing with gas.

*Surveying*—general, land surveying, mine surveying.

The classes for managers include the following:

*Geology*—general and structural as applied to the coal measures.

*Mechanics*—general, properties of steam, steam boilers, steam engines, air compressors and hydraulics.

Special classes—chemistry, mechanical drawing, electricity, steam engines, boilers, pumps.

General information—mining act.

For purposes of instruction there are five colliery districts and in each district the best man available as an instructor is appointed, the salaries being from \$1,000 to \$2,000 per year, the instructor devoting all of his time to this work. The instructors are practical men, possessed of managers' certificates, which is the highest grade attainable in Nova Scotia, and if possible they have had teaching experience in the public schools.

The duties of the regular coal mining instructors are:

(1) To conduct evening sessions in two or three towns in their district for two nights a week;

(2) To conduct day classes in mechanical drawing and mining science in the public schools for boys in grades VII, VIII, and IX;

(3) To have general charge of the preparatory coal mining and engineering classes in their respective districts.

Assistant part time coal mining instructors are engaged from among the colliery officials to carry on instruction in coal mining in the less important centers which the regular teacher cannot cover on account of lack of time. Day classes for the men who are on night shift are provided if a sufficient number apply for such instruction to warrant the forming of a class.

In the summer vacation the instructors are given special courses at the Technical College in Halifax in order to give them greater ability in teaching or are taken upon inspection trips to the mining districts of Nova Scotia and the United States.

In order to secure better attendance a small fee is charged each student but at the end of the session each year the deposit is refunded on the following basis:

For 100 per cent attendance the whole deposit is refunded.

For 90-99 per cent attendance four-fifths of deposit is refunded.

For 80-89 per cent attendance two-thirds of deposit is refunded.

For 70-79 per cent attendance one-half of deposit is refunded.

For 60-69 per cent attendance two-fifths of deposit is refunded.

Less than 60 per cent attendance none.

The classes are conducted on an educational basis and are not with a view of cramming the men to pass the examination. The examining boards are entirely separate and are not connected with the

schools nor are they under the jurisdiction of the Director of Technical Education, so that there can be no charge of unfairness in setting the examination so as to include a limited scope of questions based on a narrow field of instruction.

These technical schools are recognized by the miners as having been of great service to them and practically all of the colliery officials from overmen to district superintendents have passed through the courses. That the officials are efficiently trained is evident from an anecdote told by the late Hon. B. F. Pearson, the principal promoter of the Dominion Coal Co. One of the early managers of the Dominion Company was Cornelius Shields. He came to Nova Scotia to inspect the coal properties for a few weeks before taking over the active management. When he first arrived in Nova Scotia, he declared his intention of bringing some mine foremen from the Pennsylvania bituminous district in order to run the Dominion Coal Company's mines according to modern American methods. After his preliminary investigation he returned to the United States, but when he came back to Canada the only man he brought with him was his private secretary, so satisfied was he of the capability of the Nova Scotian mine officials.

As to the effect of these schools on the teaching of technical subjects in the day schools, F. I. Lent, Principal of the Westville, (N. S.) Schools, says in a letter to Director Sexton:

"In regard to the increased attendance in Grade IX, I may safely say that it is due, almost entirely to the introduction of drawing in the schools, by the Technical School instructor.

"The boys of the Westville Schools are very much interested in the drawing and elementary science, and I believe that the attendance of boys in grade IX, which is double that of last year, is in a large measure due to the lively interest taken in this work."

At New Glasgow it was impracticable to offer courses in mining science during the regular day school period, but when offered as optional work or Saturday a large number of boys took this extra work.

#### ONTARIO.

##### *Summer Schools for Prospectors.*

So far as the writer has been able to ascertain, the earliest attempt made in America to provide for the prospector field instruction by a teacher was carried on by the Kingston School of Mining and Agriculture, Ontario. In 1890 the Government of Ontario appointed a Royal Commission on the Mineral Resources of Ontario. In the

report of this commission, published about 1893, there appears the following recommendation:

"In order that the mineral resources of the province may be successfully and economically developed it is desirable that measures should be taken for the practical and scientific training of all who may engage in the industry. Prospectors and explorers are found to be very deficient in the kind of information which would enable them to prosecute their arduous labors to the best advantage; and your commissioners recommend for that purpose the adoption of a scheme such as has been tried with gratifying results in the colony of New Zealand, and fully explained in Appendix L."

The work was first taken up by the Kingston School of Mining, and the following quotation from the first annual report of that school, submitted April 18, 1894, is of interest.

"Some explanation is called for concerning the Special Classes and Courses alluded to.

"The Governors felt that in the circumstances of the Province, it was well to consider not only the few who aim at taking the complete course that leads to the degree of Mining Engineer, but also the many practical miners scattered over the country, who desire to learn something more than they have gained by hard experience of the industry to which they have devoted their life-work. They therefore (1) advertised a special eight weeks' course, to begin on January 9th of this year, for mine foremen, assayers, prospectors and mining men generally, and on the day named a class of seven men presented themselves to begin work. The number may seem small, but the school is only beginning, and is therefore not widely known yet, but the success of the course has been so marked that the governors are well satisfied with it, and they confidently anticipate a much larger class next year. The satisfaction of the men themselves may be judged from the responses made by them at a public meeting held in the school, at which certificates of attendance were presented to them, with expressions of approval on the part of the faculty of their great diligence and intelligence and their assiduity in studying daily from morning to night. (2) In the next place, learning that there were men who wished to gain some knowledge of minerals and mining, but who could not attend during the day, lectures were given at night, illustrated by experiments, diagrams and specimens. Twenty-three registered in this class. (3) In the next place, it was felt that in some way the school should be taken to mining men unable to come to the school. As a result of a visit to Marmora and a lecture by a member of the staff, a requisition was sent in to the Bursar, signed by seventeen, who agreed to pay \$4.00

each for a fortnight's course of practical instruction. This petition was granted, and the class at Marmora proved a decided success. Persons interested in mining, resident in Sudbury, are endeavoring to form a similar class there. This experiment has had a large measure of success in New Zealand, and it was recommended to the Legislature in the report of the Royal Commission appointed in 1890 by the Government of Ontario."

The course consisted in:

(1) Enough chemistry (with experiments) to make the class understand what a mineral is, and to be able to calculate the metallic contents of ores from their formulae.

(2) Enough mineralogy too enable the class to recognize the more common minerals by simple tests, and also to understand how to look up minerals in a mineralogical work and the usual system of classification.

(3) Enough geology to enable the prospector to know how rocks are formed and the names and composition of those usually met with.

(4) The class then was given lectures on the common ores and the rocks with which they are associated, so far as the subject could be illustrated by specimens.

(5) Finally, prospecting and boring were the concluding subjects of the course.

Blowpipe was given every morning from 9 to 11, or more often until near 12 o'clock. Great interest was taken in blow-piping and, before concluding, the class understood the tests for the commoner elements, and was able to do cupellation of gold or silver by the blowpipe.

The afternoon was occupied by a lecture from 4 to 6, and on some days between 1 and 4 o'clock the class had practical work in examining the ore heaps at the reduction works, crushing and panning ore, and short trips to investigate the geological formation of the district and the occurrence of ore bodies in connection therewith. One longer excursion was taken to see the veins and works of the Consolidated Gold Mining Company, and tests of the veins at some places were made by panning. The class collected many samples of ore, vein-matter and rocks.

One day was occupied by instruction in assaying gold and silver ores, both by the crucible and by scorification.

The lectures were illustrated by about 500 geological and mineralogical specimens, including ores with accompanying rocks. A good many colored diagrams were also used that greatly assisted the student.

The Legislature of Ontario in 1894 appropriated \$2,000 to organize summer mining schools in the northern districts of the province, and the work was entrusted to the faculty of the School of Practical Science of Toronto. Accordingly, in the summer of 1894 the Principal of the school inaugurated the work at Sudbury and Copper Cliff, the public school house being used at Sudbury, and the band room at Copper Cliff. The classes were held in Sudbury on Monday, Wednesday and Friday at seven o'clock p. m. At Copper Cliff classes were held on Tuesday, Thursday and Saturday, and, since two shifts were worked, two classes per day were held at 3:30 and at 7:00 p. m. respectively. The first classes continued from July 9th to August 16th, and from August 20th to Sept. 21st classes were held at Rat Portage on Tuesday, Wednesday, Thursday and Friday evenings at 7:00 p. m. Text-books were used at first and until the classes obtained a fair idea of the subjects taken up, when certain books were recommended for those who seemed to advance still further. Instruction was given by lectures, and where blackboards were not available, large sheets of blank paper and colored chalk were employed. The course of instruction included:

Mining geology.

Ore deposits.

Mineralogy, including practical blowpiping and the identification of minerals.

Lithology, with special reference to the rocks of the region.

Lectures were also given in elementary chemistry bearing upon the other subjects of the course.

No fee was charged, but \$2.50 was charged for a blowpiping outfit, which then became the property of the student. The time was divided so that one-half of each meeting was devoted to practical work and the other half to lectures. Special stress was laid on the value of field tests, and the lectures throughout were illustrated as far as possible with Canadian minerals. The Sudbury class contained 8, the Copper Cliff class 19, and the Rat Portage class 24. In addition to these regular attendants many others attended occasional classes.

A detailed account of the instruction under the various headings given above can be found in the Fourth Annual Report of the Bureau of Mines of Ontario for 1894, page 218.

At various times during the early years the instruction was jointly under the School of Applied Sciences in Toronto and the Kingston School of Mines, but since 1902 it has been mainly in charge of Dr. W. L. Goodwin, President of the Kingston School of Mining. In his report in 1899, Dr. Goodwin said: "There can be no doubt that

these outside mining classes are serving at least two purposes, first, to call attention to minerals in general, and the valuable minerals in particular, and secondly, to give professional and occasional prospectors correct ideas as to how to find out the value of a discovery."

The identification of mineral specimens has always formed the ground work of the instruction in these summer schools. As carried on at present, forty mineral specimens are furnished to each student, and an effort is made to familiarize him with the microscopic determination of these minerals. From ten days to two weeks is devoted to each camp. In his report for 1904, Dr. Goodwin says: "It is evident that summer schools succeed better in the more isolated camps of moderate size than they do in most places which have grown to the dimensions of villages or towns. In the smaller camps the men live together and move as one body. In the larger camps they are more or less scattered, and it is hard to get them to assemble after a day's work." In 1905 Dr. Goodwin reports that about 550 received instruction in summer classes, nearly all of whom received sets of forty specimens each. In connection with the work additional sets of minerals were distributed to many who had heard of the work, but who could not attend the classes. During 1906, 930 received instruction, and about 30,000 mineral specimens were distributed. In his report for 1907, Dr. Goodwin says: "Now that the high schools have taken up the study of geology and mineralogy, it becomes necessary to consider whether the summer mining classes may not be discontinued in the near future, or their character changed so as to convert them into summer schools of applied mineralogy and geology, held in some mining centre or centres during the months of July and August, so that they might be attended by teachers. The older prospectors and miners of the province have been pretty generally reached during the twelve years since the classes were started. It may be urged that very few prospectors and miners ever reach the high schools. For this reason and on account of the great importance of the subject, some steps might be taken to put a practical acquaintance with the elements of mineralogy and geology within the reach of every boy in Ontario. There are boys in every county who take to such studies naturally and eagerly. It is not necessary to make such subjects a necessary part of the curriculum required for high school entrance. An enterprising teacher in a country or village school will find time and energy to lead a willing lad through a simple course of observation and testing, if the specimens and a good book are available."

In regard to this work, Dr. W. L. Goodwin, Dean of the School of Mining, Kingston, Ontario, writes under date of November 7th,

1913: "We are no longer carrying on this work. Intramural classes were dropped because our staff, with the increase in the number of regular students; came to a point where they had to drop something. The value of the work was unquestionable. A considerable proportion of those who began the prospector's course took up the regular four years' course at the next session. Others continued by private study until they fitted themselves for responsible positions. Several of them became mine managers."

### *Mining Classes in Canadian High Schools.*

Under the heading "A New Departure in Mining Education" H. G. Carmichael of Sudbury, Ontario, before a meeting of the Canadian Mining Institute in 1912, describes this movement as follows:

"About two years ago, when it was found necessary to erect a new high school building at Sudbury, it was thought by many, particularly by the chairman of the high school board, Mr. D. Baikie, and by several of the prominent mining men of the district, that some attempt should be made to give instruction in those subjects directly useful to those engaging in mining, the principal industry of the district. To meet this view, it was decided after consultation with the Minister of Mines, the Minister of Education for Ontario and with the mining men of the district, to establish a mining department in connection with the new high school. The Ontario Government promised financial aid equal to that granted to the agricultural departments of the high schools in the farming districts. The new high school building was built and equipped to meet the need of the new department and a smaller building was erected to contain an assay laboratory, a sample room, and so disposed for the conduct of work of a rough and noisy character.

The actual aim of the department is to disseminate as much useful technical mining knowledge as possible to those desiring to profit by such teaching. The instruction at present is divided into high school classes and outsiders' classes. The high school course is intended for those young men of the district who intend to follow mining and who are unable to attend the universities. The course covers five years during which the following subjects are studied:

First Year:—English, arithmetic, book-keeping, algebra, practical geometry (geometrical drawing), elementary physics, freehand drawing, elementary mineralogy, and French or German.

Second Year:—English, arithmetic, book-keeping, mensuration, algebra, geometry, lettering and drafting (plain lettering, use of draft-

ing instruments, tracing, easy working drawings, etc.), physiography and elementary geology, physics, chemistry, and French or German.

Third Year :—English, algebra, geometry, physics (experimental heat, light, sound and electricity), chemistry, mining (an elementary course on methods, machinery, etc.), and French or German.

Fourth Year :—Algebra, geometry (solid and analytic), trigonometry (plain and spherical), physics (mechanics and the properties of matter), chemistry (general and qualitative analysis), surveying, drafting (mapping), and general geology.

Fifth Year :—Chemistry (analytical), assaying, mining (methods, machinery, economics, etc.), construction and design (graphics, theory of structure, etc.), ore dressing and milling, and metallurgy (general and copper-nickel).

Since only a proportion of students will take the full course, the first three years of study are devoted chiefly to high school work proper and designed to give the student not only a foundation for future study, but a general idea of what mining implies as well as to develop his interest in the industry. The last two years of the course are intended to afford a working knowledge of the more important technical subjects that will confront the student after he leaves the school.

As yet there are classes in the first three years only; but it is hoped to add the fourth next autumn and the fifth the year after. The great majority of the boys attending the high school take the mining course and a class of about five is expected to take the fourth year next autumn. The total attendance of the high school classes is about thirty-five.

The average age of entry to the first year is about fourteen. The boys of the first two years are encouraged to work during the summer in the mines or smelters as water-boys, ore-pickers or at any other work they can secure. It is compulsory that the students shall work in the mines or smelters during the last two vacations. Sudbury, in view of its proximity to important mines and reduction works, is admirably suited as a centre of mining education. Thus, there is within easy visiting distance of the school two large smelters, a cyanide mill, a magnetic concentrating works, in addition to nickel, gold and iron mines. Saturdays are devoted to visiting the mines and other plants, and so affording students the opportunity of obtaining a practical as well as a theoretical knowledge of mining.

The classes for outsiders are held at night; but instruction is given in any technical subject at other times, to any one capable of profiting thereby. The night classes held at present cover two subjects: elemen-

tary mineralogy and prospecting, and in the procedure to be followed to acquire mining lands under the Ontario Mining Act. Instruction in mineralogy covers the nomenclature of minerals and rocks, the determination of the common minerals, the ores and how they occur, weathering, etc. In the other class instruction is given on how to stake mineral claims, recording, working conditions, etc. Between ten and fifteen attend each of these classes. Instruction has been given in assaying, geology, and blow-pipe mineralogy to outsiders, in addition to the students attending the regular classes.

The mining department is governed by a committee of twelve, half of whom are appointed from the Sudbury High School Board and half from the mining men of the district. The department is administered by a director, who instructs on technical subjects.

The mining companies operating in the locality have both approved of and rendered assistance to the undertaking. The Mond Nickel Company, for example, has established two annual scholarships of one hundred dollars each, to be awarded to the most promising candidates entering the fourth and fifth year of the course, respectively. The Hon. F. Cochrane, it should also be stated, presented the school with a library of technical books.

The courses are free and open to all.

It is proposed to award a diploma to those completing the five year course and who can adduce evidence of having worked in or about the mines and smelters long enough to have acquired some practical experience of work in these directions.

The school is not intended to compete with the mining schools of the universities; but should serve a purpose of its own in the dissemination of useful knowledge among a class either unable to afford or for other reasons prevented from securing the advantages of university training.

In comparing the high school course with the regulation courses of the universities the chief points of difference are, that preparatory general education is not sharply separated from the technical but generally leads up to it; that the course is shorter, and that less stress is laid on mathematics. The serious technical work begins with the fourth year when the student has very nearly the same grounding as is required for matriculation to the universities. The course is covered in two years of ten months, against four years of seven or eight months at the universities; hence the actual difference in point of time is not so great as might at first appear. Moreover, the students will complete this course at a younger age than that of the college graduate,

and so should be more willing and better able to start actual work at the very bottom of the ladder.

The idea of attaching a mining course to the high school curriculum is novel, in Canada. Since its initiation at Sudbury, a similar department has been added to the high school at Nelson, B. C., where conditions are very similar."

In regard to this movement, Dr. F. W. Merchant, Director of Technical Education of Ontario, says under date of December 5, 1913:

"As you may suppose, the character of the work undertaken and its success has depended upon the men engaged as specialists to take charge of the classes in the schools.

The school at Sudbury, I understand, was very fortunate in getting a thoroughly trained practical man to take up the work in the beginning, but upon his appointment to another position, a man strong in theory, but lacking in practical experience was appointed and the department became disorganized. Shortly after I took charge of the Technical and Industrial Education work of the Providence last summer I had a conference with the Advisory Industrial Committee, and the mining men in the district, and I am convinced, from what I learned, that there is an opportunity for building up a fairly strong school at this place. The committee have taken up the work of reorganizing and will appoint a new head to the Department. The prospects for success are, I believe, good."

A similar school has been started in Haileybury in the silver district north of Cobalt.

#### ENGLAND.

##### *General Conditions*

The conditions in England are somewhat different from those in the United States since mine foremen or overmen are not required to pass a government examination, altho mine managers are. The managers are responsible for the control, management and direction of the mines, and in the absence of the manager the under-manager has the same responsibilities and is subject to the same liabilities as the manager.

In response to a letter of inquiry addressed to the late M. Walton Brown, Secretary of the Institution of Mining Engineers, asking for information upon secondary education in Great Britain, Mr. Brown wrote as follows:

"The education of managers and under-managers respectively, who hold first and second-class certificates, is supplied (1) by attendance at universities, mining colleges and schools, (2) by night classes

provided by the universities, mining colleges or schools, or by the county councils who have a well worked out system of county lectures; (3) by correspondence; and (4) by home study without outside assistance. In addition, the county councils and many of the large mining companies inaugurate courses of lectures on first aid to the injured, and a smaller number facilitate education by classes in mining and engineering subjects."

### *Three-Year Mining Courses*

The report of the Nova Scotian Department of Technical Education for 1912 says:

"In England the various colleges in or near coal mining districts usually give three-year courses in coal and metal mining leading to a degree of B. Sc., in these subjects. As compared with like courses in the leading engineering colleges in America, these courses are not nearly as thoro in respect to the mathematical or general engineering subjects. The courses in the English colleges consist of the more specialized instruction particularly applied to the profession of mining engineering. Such a statement does not apply to the department of the Imperial Institute of Science and Technology which formerly existed as the Royal School of Mines.

Throughout England, wherever collieries exist, there have been established technical schools in the shape of evening continuation classes or "part time" day classes for the instruction of men employed in the industry in the science and practice of mining. It is very common to find evening schools in every colliery town in a certain district with a carefully prepared course covering two or three years and the higher courses offered under the auspices of some technical college or university on one afternoon a week for 6 or 8 months of the year covering 3 years. In some of the colliery counties the general supervision and inspection is relegated to the professors in charge of the mining department of a centrally located university.

The Leeds district and the Sheffield district cover most of the important colliery towns where classes in coal mining are held in Yorkshire. The Leeds district is taken as an example because it is one of the most highly and carefully organized centers in England, and below are given the names of the places in the Leeds district where coal mining instruction was offered in 1910-11.

*Leeds District.* The County Council first-year mining course was given at the following centers, viz:—Altofts, Ardsley E. and W., Ardsley Hilltop, Batley, Bowers, Allerton, Crofton, Dewsbury, Emley,

Featherstone, Lane, Garforth, Kippax, Middleton, Normanton, Osset, Rothwell, Stanley Grove, Stanley Outwood, Wakefield and Whitley Upper; third-year courses (fifth year, new scheme) at Batley, Castleford, Dewsbury, Featherstone, Lane, Normanton, Stanley Outwood and Wakefield; fourth-year course (sixth year, new scheme) at Wakefield; Board of Education, stages two, three, and honors, at Batley and Normanton; City and Guilds courses at Batley, Castleford, Dewsbury, Normanton and Stanley Outwood. Special courses during the summer in gas-testing for deputies at Batley, Ardsley E. and W., and Stanley Outwood; in mining at Castleford; and in surveying at Dewsbury and Batley.

*Sheffield District.* The County Council makes grants to Leeds and Sheffield Universities, in return for which, free places are provided in their courses, external lecture courses are given, and local mining classes are supervised and examined. Twenty exhibitions are awarded tenable at the above universities. Special classes are held at the universities for teachers on Saturday afternoons. All classes are held in the evening or on Saturdays. There are in addition to classes enumerated above, numerous evening preparatory classes.

The regular course is supposed to be five years, (a) the first two years include general work in mathematics, science and drawing, and (b) the last three years are devoted chiefly to coal mining, and most of the work in the last three years is done at Leeds University.

For those who have not had good training in the public schools a preparatory course is offered thus making the whole coal mining course of these backward students cover a period of six years. The preparatory course is organized to give a thoro grounding in English, mathematics, freehand and instrumental drawing, wood-work and metalwork.

The first and second years of general work are taken in the Branch Artisan Schools, and include:

First year, experimental mathematics, practical mathematics, practical plane and solid geometry, hand-sketching, and English.

Second year, experimental mathematics (as above), mechanical laboratory and English.

The three years' coal mining course is intended for miners and sub-officials who are occupied in or about collieries, and who can attend only for one afternoon per week, but desire to qualify themselves for Managers' Certificates under the C. M. R. Act. It is particularly for those who have attended complete courses of instruction in mining at one of the local centers appointed by the West Riding

County Council, or have attended the preparatory evening courses of the Leeds City Education Committee.

The course extends over three years, beginning each year about October first and ending about May 1st, with Christmas and Easter vacations. The first and third year students attend on Mondays from 3 to 7 p. m., the second year students on Tuesdays, during the same hours. The instruction in engineering, electrical engineering and geology is given in the respective departments, the remaining subjects in the mining department. In the class on mathematics the subject is dealt with entirely from mining practice. Students are given mining data in the examples set, and are required to copy these out into an indexed pocketbook to form a nucleus for the observations which they subsequently make as a result of their own experience. A similar mode of treatment is adopted for the chemistry course, the properties of matter and chemical change being illustrated as far as possible from ordinary examples to be met with at a coal mine. In addition to the course of surveying drawing, a course of practical work in the use of surveying instruments is given during the third term. Lectures are given in connection with the two surveying courses as they become necessary to explain the work in hand."

#### SYLLABUS

First Year	Second Year	Third Year
Mathematics	Mining	Mining
Engineering	Chemistry of Coal Mining	Electricity
Engineering Laboratory	Surveying	Electrical Engineering
Mining	Geology	Laboratory

#### *Saturday Lectures.*

As an example of Saturday lecture courses, those carried on by Armstrong College, Newcastle-upon-Tyne, are probably representative. This course extends over three winter sessions and involves attendance for about twenty-four Saturday afternoons from three to five o'clock or from four to six. Each series is as far as possible independent of the others and complete in itself, so that the student may enter any of the courses. The fee for the series of four courses given each session is £1 10s. It is desirable that the students be not less than 17 years of age, and students entering the course must possess a knowledge of arithmetic, algebra and mensuration, including,

- (a) Arithmetic: the ordinary rules of arithmetic, including simple proportion and vulgar and decimal fractions.
- (b) Algebra: as far as simple equations, including square and cube roots; and a knowledge of the power of a number, such as  $x^3$  or  $x^4$ .

(c) The use of logarithmic tables.

(d) Mensuration: areas of rectangles and of triangles; areas and circumferences of circles; surfaces of cylinders; and contents or volumes of cylinders and prisms.

Colliery owners very frequently pay the fees and the train fares for some of their employees attending these lectures. The Council recommends that colliery owners and others who send students to these classes should insist upon home work being done regularly.

Examinations are held at the end of each course in the respective subjects. Certificates are granted to those students who attend satisfactorily and pass the examinations thruout the three years' course, and prizes are awarded annually to the two students who do best in the aggregate examinations of the year.

The subjects are arranged as follows for 1913-14:

Term beginning:		Time.
Oct. 4, 1913.....	The steam engine,	3.00 to 3.50 p. m.
	Theoretical electricity.	4.05 to 4.55 p. m.
Jan. 10, 1914.....	Electrical engineering,	4.05 to 4.55 p. m.
	Haulage and winding,	5.10 to 6.00 p. m.
1914-1915	Transmission of power,	
	Pumping and ventilation.	
" "	Metallurgy of iron and steel,	
	Mining machinery.	
1915-1916	Machine drawing,	
	The Chemistry of Fuel.	
" "	Strength of materials,	
	Experimental mechanics.	

#### SOUTH AFRICA.

##### *Miners' Training School, Transvaal.*

The following notice regarding a miners' training school was published by the Government of the Transvaal in Pretoria, S. Africa, April 27, 1911:

Notice is given that a Government School for Training of Miners will be opened on or about the 1st day of July, 1911, at the Wolhuter Gold Mine, Johannesburg, and that there will be vacancies for fifty apprentices under the following conditions:

- (1) Youths selected to undergo a general course of underground training shall be of first-class physique, and shall pass a rigorous medical examination.
- (2) No person under seventeen years of age or over twenty-five years of age shall be allowed to undertake such course.
- (3) An agreement with the committee binding him to work for a period

of three (3) years underground in consideration of a progressive wage shall be entered into on behalf of the apprentice.

- (4) The three years' course shall comprise, amongst other matters, training in the following underground work:

- Timber work.
- Pipe and plate laying.
- Pumps.
- Hand drilling.
- Machine drilling.
- Ambulance.
- General mine work.

The time to be occupied on each of the above branches of work, and the order in which each branch, with the exception of machine drilling, is to be taken up, shall rest with the discretion of the instructor.

- (5) At the expiration of his period of underground apprenticeship, the apprentice shall be given a certificate stating fully that he has served his apprenticeship on one or more mines.

The application form and draft of indenture are published herewith for general information.

All applications must be forwarded to the Secretary of the Board of Control, Government Mines Training School, P. O. Box 1132, Johannesburg.

#### APPLICATION FORM.

##### FOR APPRENTICESHIP IN GOVERNMENT MINE TRAINING SCHOOL.

- (a) Name in full .....
- (b) Date of birth .....
- (c) Name and address of parent or guardian.....
  
- (d) Name and address of one other surety, in terms of Clause 3 of the indenture .....

Signature.....

.....1911.

Note.—The following certificate to be attached to this application:

- (a) A medical certificate especially in respect of the condition of applicant's lungs.
- (b) A certificate of character from a magistrate, justice of the peace, clergyman, or other responsible person.

##### GOVERNMENT MINES TRAINING SCHOOL INDENTURE.

This indenture, made on the ..... day of ..... 19....., between the Government of the Union of South Africa, represented herein by the Mines Training School Committee for the time being (hereinafter called the committee), the said committee being

duly authorized thereto by Executive Council Resolution, dated \_\_\_\_\_ day of \_\_\_\_\_ 19\_\_\_\_\_ of the first part, \_\_\_\_\_ (hereinafter called the guardian) of the second part, and \_\_\_\_\_, of the age of \_\_\_\_\_ years, the son (or ward) of the guardian, hereinafter called the apprentice, of the third part.

Witnesseth:

1. In consideration of the service of the apprentice to be done or performed to or for the said committee, and the covenants hereinafter entered into by the apprentice and guardian, the said committee does hereby covenant with the guardian, and also by way of separate covenant with the apprentice, that the said committee will take and receive the apprentice as its apprentice for the term of three years next ensuing from the day of the date of these presents, and also will during such time, to the best of its power and ability, instruct, or cause to be instructed, the apprentice in the various branches of underground work and in all things incident or relating thereto, in such manner as the said committee does now or shall hereafter during the time aforesaid carry on the same.

2. The guardian and one other surety shall bind themselves jointly and severally to pay the committee the sum of £10 (ten pounds sterling) should the apprentice indentured herein fail to complete his term of apprenticeship as set forth in this agreement.

3. The said committee will pay the apprentice during the time aforesaid or until the sooner determination of the said apprenticeship the wages or sums of money following, that is to say:

For the first three months of service, 4s. 3d. per day worked, or on a basis of this rate for any portion of a day worked.

For the next six months of service, 4s. 6d. per day worked, or on a basis of this rate for any portion of a day worked.

For the next six months of service, 4s. 9d. per day worked, or on a basis of this rate for any portion of a day worked.

For the next six months of service, 5s. per day worked, or on a basis of this rate for any portion of a day worked.

For the next six months of service, 5s. 6d. per day worked, or on a basis of this rate for any portion of a day worked.

For the next six months of service, 6s. per day worked, or on a basis of this rate for any portion of a day worked.

For the last three months of service, 6s. 9d. per day worked, or on a basis of this rate for any portion of a day worked.

These rates being on a forty-eight hours' week, and not exceeding eight hours in any one day at the face, except in cases of accidents or other emergencies when necessity demands it.

4. At the expiration of three months any of the parties hereto shall be at liberty to cancel this agreement, which shall thereupon be of no further force or effect, but if no notice of cancellation be given in writing by any of the parties hereto to the other parties concerned, this agreement shall continue of full force and be binding on all parties concerned for the full term of three years aforesaid.

5. The officer appointed for the time being to instruct the apprentice, hereinafter called the instructor, may put the apprentice on piece-work, provided that the total money earned in any period, not exceeding three months, shall not fall short of the above specified rates of pay; bonuses may be granted in respect of work done, such bonuses to be payable on completion of each contract, or otherwise as the committee may determine.

6. The increase of pay as detailed in Clause 4 shall be dependent on the committee being satisfied that the apprentice shows reasonable improvement in his training, and that he is careful, diligent, obedient, and attentive to the regulations and to the instructions given by the instructor or any one acting on his behalf for the time being.

7. The periods specified under Clause 4 shall be based upon the number of shifts worked, and the apprentice may be called upon to make up any shifts lost in each period at the rate of pay apportioned to such period.

8. In consideration of the covenants and agreements hereinbefore contained on the part of the said committee, the guardian doth hereby place and bind the apprentice, and the apprentice, with the consent of the guardian, doth hereby place and bind himself with and to the said committee during the aforesaid term of three years. The guardian and the apprentice do hereby jointly and severally covenant and agree with the said committee that the apprentice will join any medical or benefit society established for the employees of the said committee, and shall conform to the rules and regulations thereof, and that the committee shall be entitled to deduct each month from the wages of the apprentice such sums as may be due by him to the committee for rent of the committee's premises, for stores, electric light, and water supplied by the committee, and any subscriptions due to the aforesaid medical or benefit society and to the reading-room and recreation hall, also any sums due for board to any boarding-house keeper or co-operative mess, and the committee shall be entitled on behalf of the apprentice to pay such subscriptions or sums to the parties entitled thereto.

9. Deductions from the apprentice's pay in regard to the following items shall not exceed the undernoted sums:

Board and quarters, per month, £3. 5s.  
Medical and benefit society, per month, 7s.  
Reading-room, per month, 1s.

10. The guardian and the apprentice do hereby jointly and severally covenant and agree with the said committee that the apprentice shall, during the said term of three years, faithfully, honestly, and diligently serve the said committee and obey and perform all lawful and reasonable commands and requirements of the committee or its duly authorized servants, and conform to the rules for the time being of the said committee, and shall not do any damage or injury to the said committee, and shall not do any damage or injury to the said committee's property, goods, machinery, or stock-in-trade, or knowingly suffer any such damage or injury to be done without acquainting the instructor or secretary of the said committee for the time being therewith, but shall in all things conduct and acquit himself as an honest and faithful apprentice ought to do. And, further, that the apprentice shall attend during the term of his apprenticeship such class or classes as may be arranged by the committee, such instruction to be free of cost to the apprentice.

11. On completion of the full term of apprenticeship, an endorsement shall be made on this agreement, and signed by the chairman of the committee, and the agreement handed over to the apprentice.

12. With the consent of the committee, the guardian, and the apprentice, parties hereto, the services of the apprentice under this agreement may be transferred to any mining company, and thereupon the guardian and apprentice and such mining company, on agreeing to such transfer, will be bound by all the terms of this agreement for the unexpired period hereof as fully as if such mining company had been a party thereto originally. Such transfer shall be effected by the endorsement thereof on this agreement signed by the parties thereto.

13. In the event of the committee ceasing to exist or temporarily suspending operations, either in whole or in part, so as to make it impossible for the committee to carry out this agreement, the committee may forthwith terminate this agreement, and will in such case endeavor to make suitable arrangements for the apprentice.

In case the apprentice shall commit any breach of the terms of this agreement or, in the opinion of the instructor, be guilty of irregularity, carelessness, or uncleanness in his habits or show a want of application or otherwise be found unfit to pursue the various branches

of underground work, the committee may forthwith terminate this agreement.

14. The apprentice shall upon leaving the service of the committee from any cause whatsoever in terms of this agreement be bound to quit and give up possession of any room or rooms belonging to the committee of which he may be in occupation, and in the event of his failing to do so the committee may, without legal proceedings, and without any notice whatsoever, forthwith retake possession of the premises, and, if necessary, eject the apprentice therefrom.

15. In witness whereof the contracting parties hereto have hereunder set their hands on the day and year first aforeswitten.

-----  
Chairman of Committee.

As witnesses:

1. -----  
2. -----

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Guardian.

1. -----  
2. -----

-----  
Apprentice.

1. -----  
2. -----

H. WARRINGTON SMYTH,  
Acting Secretary for Mines.

In the annual report of the Miners' Department of the Union of South Africa under date of February 27, 1913, the following report of the operator of the school appears.

*Report of 18 months' work.*

The school having been in existence for nearly eighteen months at the end of 1912, it is possible to review the results achieved during that period and to form some idea of the scope and utility in the future.

First Object of School.—The first intention of the Government in establishing the school was to provide an opening for the youth of the poor white class, so many of whom are settled in the industrial centers. It was quickly found, however, that the scheme would not answer this purpose.

Poor White Class.—This class of youth did not come forward, and the Inspector of White Labour, who personally canvassed the poorer suburbs, failed to arouse any enthusiasm among the very class for whose benefit the scheme was instituted. Our experience gained from the few who did join shows that far greater disciplinary powers would

have to be possessed by the school before they could be made into reliable miners.

We have had therefore to depend on a more limited class for recruits to the ranks of skilled miners.

Considering the advantages of the scheme and opportunities offered for learning a lucrative trade, the response has been most disappointing, as at the end of 1912 only forty-six apprentices were in residence, and only once, for a short period, has the school attained its full complement of fifty.

The reasons for this failure have had the serious attention of the Board and may be formulated as follows:

- (a) The miners' phthisis scare.
- (b) Dislike of hard work.
- (c) Impatience of control and of the indenture period of three years.

The first cause is deep rooted and will be overcome only by time and representations as to the healthier conditions now obtaining underground. The second will succumb only to educative disciplinary measures, and the third will remain as long as semi-skilled miners can earn good wages. The greatest difficulty has been experienced in convincing the apprentices that the whole trade of a skilled miner cannot be learned in nine months.

Since the opening of the school 107 apprentices have signed their indentures. This number is disposed of as follows:

Resigned at end of three months' probation.....	26
Resigned voluntarily to better position.....	8
Resigned as medically unfit.....	7
Dismissed for misconduct or as unsatisfactory.....	20
Still in residence.....	46
Total .....	107

The number of dismissals for loafing were necessitated by the lack of severe disciplinary powers. In the event of an apprentice habitually malingering, the only course is to dismiss him without the chance of our inculcating habits of industry.

I am pleased to be able to say, however, that after this weeding out process, the apprentices left in the school are very satisfactory and will make good miners.

About half the present number have good educational qualifications, and can thus avail themselves of evening technical classes, so that in time with our thorough practical training as a basis, they may be well fitted for higher positions.

Apprentices Transferred to Neighboring Mines.—After the school had been in existence about a year it was found that the stope set apart

for the apprentices, though excellent for training in preliminaries under safe and healthy conditions, did not furnish a very wide experience. The managers of some of the neighboring mines were therefore approached with a view to their taking charge of some of the senior apprentices and putting them through the various branches of underground work under skilled supervision.

This they at once consented to do, and in this connection I have to acknowledge the services of the managers of the Wolhuter, Nourse, Meyer and Charlton, and City and Suburban Gold mines.

This practice has proved very successful. The apprentices appreciate its advantages and the managers report very well on them on the whole. It also has the advantage of securing them a footing in the mines, as a manager would always be glad to retain the services of a man whom he knows by personal experience to be a careful, well-trained miner.

**Wages.**—One of the great advantages offered by the school is that, upon joining, an apprentice becomes self-supporting.

Free quarters and the low rate for board leaves a surplus for pocket money even out of the initial rate of pay of 4s. 3d. per shift.

**Bonuses.**—It was soon found, however, that on a uniform rate of pay the loafer came off as well as the worker, and great dissatisfaction arose. The Board thereupon instituted a scale of bonuses and beneficial results were immediately manifested.

Apprentices who work on the neighboring mines are granted a fixed daily bonus. The industrious, steady apprentices earn as much as £5 in pocket money per month.

**Scale of Bonuses.**—The scale of bonuses is as follows:

**Hand Drilling.**—One penny per inch over 36 inches up to 50 inches. Over 50 inches, twopence per inch.

**Machine Drilling.**—Sixpence per foot over 20 feet. Two apprentices to each machine.

**Lashing and Tramming.**—Sixpence per truck over minimum of seven per each apprentice on the work.

**Work of Apprentices.**—An apprentice upon joining the school is started at the very beginning on lashing, tramping, carrying jumpers, etc., because as he will later have to supervise others doing this work, he requires to know all about it. At first there was some talk of "Kaffir work," but this chiefly came from the class of poor whites before referred to. He next goes on to hand drilling, then machines, and after he has completed a year in the school and proved to be steady he qualifies for his blasting certificate, and is drafted to a neighboring

mine for wider experience in timbering, pumps, pipe and plate laying and general mine work.

**Evening Classes.**—Under the control of the School of Mines and Technology, two evening classes per week are held at the school. At these classes are taught arithmetic, elementary trigonometry, and drawing, subjects such as a miner would need to know to enable him to measure up his work and do simple calculations.

Some of the apprentices require more tuition in general knowledge and show a keen disposition to make up for early deficiencies, so to meet this demand, since November last, a third class per week has been arranged for general elementary subjects.

These three classes and the ambulance class are held in the recreation room, thus depriving the apprentices of their room for four nights in the week. In the summer time this is no great hardship, but in the winter will bear hardly upon them. I should explain that only half the number of apprentices can attend each class.

**Ambulance.**—After a long delay, owing to inability to obtain equipment, a weekly ambulance class has been started under the direction of Dr. Van Niekerk, Mines Medical Inspector. Every apprentice before he completes his indentures will have his first-aid certificate.

#### FRENCH SECONDARY MINING SCHOOLS.\*

To train mining engineers there are two large schools at Paris and Saint-Etienne. Technical education in underground methods of working to train assistants for these engineers is given also in two principal schools at Douai, in the north, and Alais, in the south. Also the committee of miners of the Loire district, organized in 1892, at Saint-Etienne, for the miners of that region, a school called the School for Foremen (*Aspirants-gouverneurs*). It is well also to mention the school at Anzin, especially created by the company of the mines at Anzin for the benefit of its employees.

Before studying the organization of these four secondary schools it is well to enumerate the different employees working in the mine under the orders of a mining engineer.

First comes the inside foreman having general supervision of the inside work. The tracing of plans and the surveying operations are done by a surveyor.

The mine is divided into several sections in each of which there are about 100 workmen. Over each of these sections there is an assist-

\*Originally published in *Mines and Minerals* for November, 1909, and taken from data furnished the author of the present bulletin by Mr. Dumaine.

ant foreman or assistant governor who is also helped by a master miner. The shot firers have charge of the blasting in the mines.

These employees are trained in the four schools of Douai, Alais, Saint-Etienne, and Anzin.

#### THE SCHOOLS OF DOUAI AND ALAIS.

*Organization.*—The two schools of Douai and Alais are directed by the chief engineer of the mining district in which the schools are located. The instruction is given by three professors, one having charge of the teaching of mathematics, and the making of plans and drawings; the second, of natural sciences and exploitation of mines; the third teaching French. A bookkeeper has charge of the management of expenses, and a proctor has charge of the discipline.

These schools are boarding schools. The price of the board is \$100 a year, but a large number of students receive free scholarships. The schools are supported by appropriations from the minister of public works, by the departments of Gard and Nord, and by the cities of Alais and Douai. The administration of these schools is under the supervision of an administration composed of a certain number of high dignitaries of the department.

The scholars have no uniforms but simply a cap with silver braid and insignias embroidered on the lapels of their coats. The total number of students in school is usually 40 at Alais and 60 at Douai.

The length of the course is two years. For half of this time the students receive at the school theoretical instruction, an account of which will be given later; the other half of the time is spent either in the mines of the district or in other more distant mines where according to their ability and on the judgment of the director of the school the students are employed in the work of exploitation, drawing of plans, etc. During these practical exercises they pay their own expenses by means of the salaries which they receive, according to their work, from the companies which employ them.

The greater part of theoretical instruction is given at the beginning of the school year, which lasts four months and a half, from October to March 1. After working two months in the mines, the students come back to school the first of May, where they stay two months, May and June, during which time they review the courses that were taught during the winter months. At the end of the month of June they pass an examination before a special commission composed specially of engineers designated by the administration council. Again they spend in the mines the months of July, August, September, and the first two

weeks in October, and they come back to school for their second year, following the same general program as in the first year.

*Condition of Admission of Students.*—The students are chosen from among young men of more than 18 years of age, already familiarized by a sojourn of 18 months at least in mines or underground quarries with the practical duties of a miner. Most of the candidates are from the mining districts, and for the school of Alais, specially from Gard, Loire, and Allier districts; for the school of Douai, from Nord and Pas-de-Calais. During the month of July they pass an examination for admission before an examiner named by the Sous-Préfet of their district. This first examination serves to eliminate the candidates who have not sufficient instruction to pass the final examination with a chance of success. The final examination takes place in October, at Alais on one part, and at Douai on the other part, before a special commission. The candidates must show that they possess satisfactory elementary instruction comprising reading, spelling, the first four parts of arithmetic, decimal numbers, and the metric system. Besides, they may pass an examination on optional subjects as arithmetic, algebra, geometry, trigonometry, physics, and chemistry. The examiners also question them on the practical knowledge they have acquired in mine exploitations. The amount of this practical knowledge has great weight in admitting the candidates.

*Course of Study.*—The course of study comprises first, French; second, elementary knowledge in arithmetic, algebra, and geometry, which is necessary to follow intelligently technical courses; third, special courses in topography, physics, chemistry, mechanics, mineralogy, geology, and exploitation of mines. The students have also to follow courses in machine drawing, tracing of plans, land surveying, mine surveying, leveling, road making. They also make excursions for geological studies under the guidance of a professor of geology.

The teaching is done in a spirit essentially practical in order to be always understood by the students. The indispensable subjects presented in a simple form are alone required from the students. Supplementary subjects are optional and are required only from those who have had sufficient knowledge at the time of their arrival at the school.

The time that the students spend in mining exploitations is employed in different work, and they are employed as laborers, or surveyors. During that time they must turn in a report concerning their work. Upon coming back to school the students turn over these reports to their professors and they are questioned on the knowledge that they have acquired during their working time. The students work in the

mines at four different times during their two school years, and as far as possible they are sent to mines of different kinds.

The students who have obtained 65 per cent of the total number of points receive a diploma. They easily find positions in France or foreign countries as assistant inside foremen (porions), master miners, surveyors in mines. A certain number reach more important situations. The students of Douai and Alais may be classed according to the following table:

	<i>Per Cent</i>
Managers of mines in France or in colonies.....	10
In coal mines.....	30
In mines other than coal mines.....	40
Diverse situations .....	20

#### SCHOOL OF ASPIRANTS-GOUVERNEURS AT SAINT-ETIENNE.

In the mines of the mining district of the Loire, difficulties of all kinds and dangers have increased with the development of the mining industry. The situation has grown to a point where the old foremen did not have the qualifications which the operation of the mines demanded. They had no longer the necessary knowledge to grapple with the increasing difficulties, and to understand and apply the rules of administration which had become more and more numerous and complicated.

It would have been a mistake to create at Saint-Etienne a school similar to that of Alais or Douai, where in reality they train surveyors, managers of mines, and chiefs of small exploitations. The teaching had to be more practical, more elementary.

*Organization.*—The students are chosen from among intelligent young workmen of good character, who work in the mine part of the day. Each mine in the district which is part of the Comité des Houillères may send to school one workman for each 200,000 tons or fraction thereof of annual output. The candidates must have worked for two years at least inside the mine and have finished their military service.

The entrance examination is composed of exercises in spelling, in arithmetic, and a problem.

The mine owners do not take any engagement with the workmen who are sent to the school excepting that they allow them a salary of 5 francs per day (\$1) spent either at work or at school.

The length of the course is one year, from October to the last of July. The teaching is given every day except Sundays and holidays from 3 to 6 o'clock. Students spend the mornings at work in the mines.

The teaching is done by a professor-director and a professor.

Their salaries and all the expenses are under the charge of the Mining Committee (Comité des Houillères).

The aim of the teaching is to give the students the clearest examinations possible in connection with the subjects that are essential to the operation of mines. The explanations are given:

1. On the underground conditions, work of the men and tools, use of explosives, repairs, ventilation, lighting, and plans of mines.

2. On the administrative laws.

This teaching is supplemented by the fundamental principles of mechanics, physics, and chemistry.

*Results.*—In 15 years about 200 students, that is to say, about 13 each year, have completed these courses and occupied the following positions: Inside foremen, 26; assistant foremen, 86; fire bosses, 12; watchmen, 4; dead, and others, 72.

The mining companies of the Loire district are well satisfied with the results given by the school. They do not regret the expenditures they have made and are decided to continue them in the future, and even to enlarge them.

#### PREPARATORY SCHOOL OF THE ANZIN MINES.

*Organization.*—A preparatory school is also situated at Anzin. This school receives only the workmen of the company of at least 16 years of age and already familiarized somewhat with the practice of mining. They must have an elementary knowledge of reading, writing, spelling and arithmetic. The candidates who desire to follow the course pass a preliminary examination in the division of which they are a part. A classification is made among the candidates of each division and the first four are designated to take a final examination at Anzin, where the preparatory school is located. A new classification is here made among the students of each division and the first two are admitted to follow the course. For this examination a rating is given on behavior and work by the directors of each division.

The length of the courses is 2 years, each year counting from the first of January to the 15th of November. The studies are followed three days a week, Tuesdays, Fridays, and Saturdays, the students of both years being in attendance the same day, one professor taking the students of the first year, another those of the second.

The length of the lesson period is  $1\frac{1}{2}$  hours, from 5 o'clock to half past 6. Half this time is devoted to the lectures and the other half to explanations and interrogations.

The first year's teaching comprises the principles of physics, mechanics, French, arithmetic, and plane geometry. The second year

includes physics and mechanics, French, the exploitation of mines, a little geology, and the tracing of plans.

The students take notes and arrange them at home, try to improve their writing, making their sketches as fine as possible. Special rating is given for writing and drawing, and by the way their notes are kept during the school year. The students have to write three compositions and pass an oral examination at the end of each year before three professors.

The percentage obtained for the three compositions and the examination serve to classify the students. Classification of students of the first year comprises three classes:

- (1) The students who are able to be promoted to the second year;
- (2) students who have to repeat their first year's studies; (3) students who have been refused to pass into the second year.

A diploma of studies is given to the students of the second year who have obtained the necessary number of points. Those who have not acquired that number of points receive a certificate of studies. Besides, prizes are given to the three first students of each year.

Students who have finished their studies and who during their sojourn at the school have given satisfaction by their behavior and work are called as needed to fill places as overseers of work or in other positions if their work and behavior continue to be all that is desired.

#### GERMANY.

##### *Secondary Mining Schools.*

The data following for the general account of the schools for miners and mine officials in Germany are taken mainly from the Annual Report of the Department of Technical Instruction of Nova Scotia for 1912 by Director F. R. Sexton.

In Germany, especially in colliery districts, the mining companies in each district form an association for the establishment and maintenance of a mining school for the training of the mine officials in that district without any grant from the government. The members of such an association usually include representatives of all collieries with a certain minimum output per year. An annual tax is levied on the output of mines which are represented voluntarily in the association and in Essen this tax is 4 pfennig per 20 metric tons. Besides the central schools, preparatory schools are maintained by the mining companies at various points in the district. At the central mining school the training is given in the daytime for 20 to 24 hours a week for 2 or 3 years, but at the preparatory schools the instruction is usually given in the evening. In Aachen the students are given a uniform and are

paid a small sum (about 50 cents) a day for every day they attend the school. This sum, together with the money they earn by working regular shifts in the mine on days when the school is not in session, enables the students to support themselves while obtaining their education, even tho married. In Essen the yearly report of the mining school for 1910-11 shows about one-third of the entering students as married men. These schools are usually free to students who work and live in the district in which are located the collieries that provide the funds, and pupils from outside pay a small fee.

The mining organization in Germany includes more minor officials than are common in America, so that it is impossible to give an exact translation of the names of the German officials. In the Essen district a coal cutter (hand work) earns about \$500 a year. As assistant foreman (Hilfssteiger) gets \$650 to \$750 a year, underground manager or foreman (Steiger) receives \$800 to \$1000 annually, and the manager (Obersteiger) is in receipt of a salary of \$1250 to \$1500.

There are scarcely any officials who have not been thru the regular course in a mining school. The examination is conducted by a board on which are the government mining inspectors, local or district government officials, the faculty of the school and representatives of the coal mining operators. The man who passes thru the school and examination receives a government certificate of proficiency and is accorded some social prestige according to his grade of diploma. The instruction in the school is of such a high order and so thoro that very few fail in the examination.

No boys are received into the mines until they are 16 years of age, so that they usually stay in the public schools until that time, then they attend a continuation school until they are about 18 years old. In Prussia the mine operators are compelled by law to allow any boy in their employ to attend a continuation school which is recognized by the state or local authorities until he is 18 years of age. At 18 he may enter the mining preparatory school and get ready to enter the mining school. No students are received into the mining school who are not 20 years old and who have not had four years of practical experience in mining. Some do not enter until they are much older, and the report of the Mining School at Aachen gives the ages of the pupils from 20 to 35 years. Men cannot enter the Mining School unless they are recommended by the mine operators, because the scholars are supported by the latter.

One of the state mining regulations provides that the mine air in any colliery must have not more than 1 per cent of fire damp in any

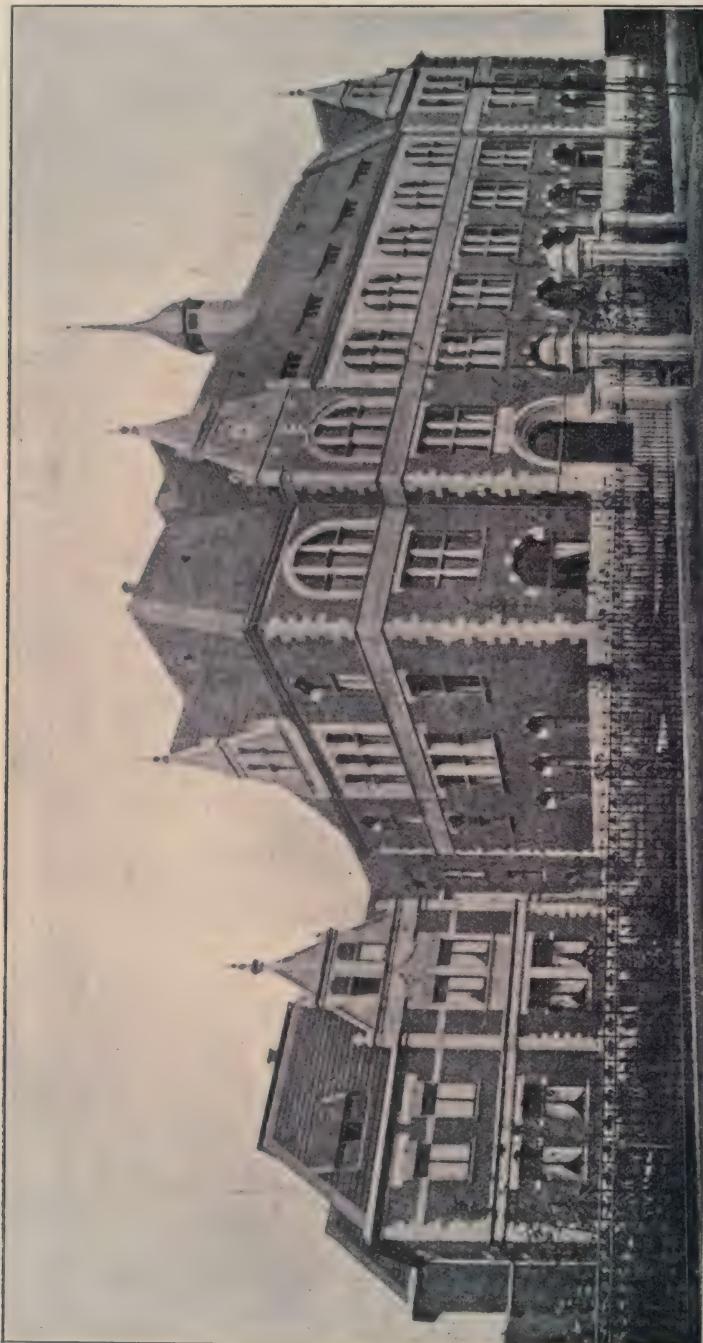
part of the mine that is working. The sample taken every 3 months by the fire boss is sent to a laboratory that is maintained in each district by the mine operators and is usually included in the mining school building of the district. The coal mining industry of Germany is in a very flourishing condition at present. In the Aachen district, the increase in output in the last few years has been about 20 per cent a year. With the increase in depth and extent of working in the mines the problem of coping with fire damp has also grown more difficult, so that the mining schools have been sorely taxed to provide the necessary number of mine officials. Germany stands third in the low loss of life per 1000 employees and the directors of the school attribute much of this satisfactory condition to the thoro education of the miners and mine officials.

### *Bochum Mining School.*

One of the best known German secondary mining schools is that at Bochum. The following description of the school is taken from a paper by Professor Henry Louis read before the Institution of Mining Engineers of Great Britain in 1910.\*

1. This school is not intended for the education of mine agents, viewers, mining engineers or inspectors of mines, such education being provided for elsewhere in institutions of university or polytechnic character, such as those at Freiberg, Aachen, Charlottenburg (Berlin), etc. 2. That it is intended only to supply the needs of the Westphalian mining district, other districts possessing similar, though perhaps less important, mining schools, such as that at Saarbrucken, etc. The school is maintained by the Westphalian Miners' Fund (Westfälische Bergwerkschafts Kasse), the origin of which goes back over three and a half centuries, dating from the mining ordinance of Duke William IV. of Cleves in 1542; the scope of this was enlarged by successive additions, until the whole was consolidated by the Act of King William I. of Prussia, dated June 5, 1863. The Act fixes the area to which it shall apply, which may, for practical purposes, be looked upon as identical with the chief mines inspection district (Oberbergamtsbezirk), of Dormund, settles the principles of its application, and also provides for an annual general meeting of all the constituent mine owners. The operations of the fund are controlled by regulations drawn up by the corporate body of mine owners, constituted in accordance with the above Act, and subjected to the sanction of the Minister of Commerce for the time being, the existing regulations bearing the date of March

\*Transactions, Institution of Mining Engineers, Vol. XI, P. 405.



BOCHUM MINING SCHOOL

17, 1908. They set forth that the objects of this fund, the headquarters of which are situated at Bochum, are:

"The improvement and advancement of mining within its own district, more particularly by means of the maintenance of schools for the training of mining officials, the production of geological and mining maps, the conduct of experimental stations, the formation of collections of minerals, fossils, etc., and the maintenance or support of scientific or technical institutions for the advancement of mining."

It is provided that a budget of expenditure shall be submitted to the annual general meeting. The income is derived in small part from the interest of certain properties, amounting to but little over £1,000 per annum, and in the main from a levy on the output of the district. Although the latter does include some metalliferous mines, it is so essentially a coal mining district that the others may be neglected, and the levy be calculated upon its coal output. According to the regulations, this levy cannot exceed 0.5 pfennig, or, say, 1-16 pence, per ton of output; and it appears usually to fluctuate between 0.4 and 0.5 pfennig (1-20 to 1-16 pence). The fund is managed by a committee of nine, each of whom is elected for a period of three years by the general meeting of constituent members.

The inspection district of Dortmund has a length from east to west of about 50 miles, with an average breadth of about 15 miles, the town of Bochum being situated near its center, and connected with the more remote network of railways, and with the nearer ones also by a system of electric tramways. The district has an annual output of about 85,000,000 tons of coal and employs about 350,000 miners. The income of the mining fund from this source would, therefore, be about 425,000 marks, or over £20,000. The average net profits of coal mining in this district may be taken as of the order of 1 mark per ton, and the value of the coal produced about 11 marks per ton, so that the levy amounts to about 0.5 per cent on the net profits of the collieries, and to 0.045 per cent on the value of the coal.

The Westphalian miners' fund maintains a number of preparatory schools (*Vor-Schulen*) throughout the district, there being 25 of these at present in addition to the Bochum Mining School. These are well distributed over the entire coal field, so that one or other is tolerably convenient of access from any part of it. Their objects are the better education of the working miners as well as to supply the preliminary stages in the training of the colliery officials. They correspond in some measure to the evening continuation schools in this country (England), but have the advantage that they are controlled by the mining companies, and thus give a training specially suitable for miners.

Miners are admitted to the preparatory schools, provided that they are at least 18 years of age and have been employed in mines for not less than two years. Should there be more applicants for admission than there are vacancies those who appear to be the most suitable candidates are selected, either by examination or in any other manner as may be decided by a board which controls these schools. The course of studies lasts for two years, and students have to attend eight hours weekly during the first three half-years, and 10 hours weekly during the last half-year.

The subjects in which instruction is given in the preparatory schools are the following:

1. German language: 4 hours per week in the first year; 2 hours in the second.
2. Arithmetic and geometry: 2 hours per week.
3. Drawing, freehand and geometrical: 2 hours per week.
4. Elementary natural science: 2 hours per week in the second year.
5. Legislative enactments for miners: 2 hours per week in the last half-year.

Instruction is gratuitous, and in 1910 in the twenty-five preparatory schools in the Dortmund District, there were 811 pupils and 69 teachers.

The Bochum Mining School (Fig. 6) is the principal teaching center, and the only one at present in which any true technical education is given. Its development has been a slow and steady one, and the present system has been reached as the result of a long series of teaching experiments. The school now gives instruction in two separate divisions:

1. The Lower Division, intended for colliery officials (deputies, overmen, etc.), and colliery (mechanical) engineers.
2. The Upper Division, intended for under-managers or managers, and for higher colliery (mechanical) engineers (shop foremen, foremen in charge, etc.).

The Dortmund inspection district contains about 350,000 miners and there is approximately one official to every 80 or 85 miners, so that over 4,000 officials are required for the entire coal field. The average age at which a man leaves the mining school and takes an official position is 28 years; the average age at which an official retires from active work is 53 years; so that, allowing for those who die or leave the pits for other reasons, the active career of a mine official may be estimated at 22 years; hence, it will be seen that about 180 new officials will at

present be required every year to maintain the supply. Further, it must be remembered that this coal field is in process of rapid expansion, the last decade having shown an annual increase of about 14,000 miners yearly, for whom about 170 officials would be required, so that the district requires at present altogether some 350 new officials each year.

In 1910 there were 300 pupils in the lower division and 50 in the upper division. The subjects taught in the Mining School are the following:

- |                                        |                              |
|----------------------------------------|------------------------------|
| 1. Drawing                             | 7. Dressing (coal-washing).  |
| 2. Mathematics.                        | 8. Mineralogy and petrology. |
| 3. Mechanics and machine-construction. | 9. Natural science.          |
| 4. Electricity.                        | 10. Mining jurisprudence.    |
| 5. Surveying                           | 11. Mining calculations.     |
| 6. Mining                              | 12. Underground rescue-work. |

In the classes for engineers especial attention is paid to machine-drawing, mechanics, machine-construction, electricity and the preparation and washing of coal.

Before he can be admitted to the school the applicant for admission into the mining section has to show that he has been engaged for at least four years in the pits and that he is a skilful and industrious workman; as a general rule he must have reached at least the standing of a hewer.

Applicants for admission into the mechanical section must submit proofs that they are skilled fitters, smiths, or mechanics, of at least four years' standing in their trade, and that they have had experience in the erection and running of machinery; they are, however, allowed to count one year of underground work as part of their four years' practical experience.

Candidates have to give evidence of a sufficient elementary-education and of aptitude for drawing, this being determined by a suitable examination. It is by no means indispensable for them to have passed through any of the preparatory schools.

Candidates for the upper division comprise, as a rule, only those students who have successfully completed the two years' course of the lower division, although exceptionally they may be admitted on the presentation of evidence that they are properly qualified by some other course of training, this being determined, when required, by examination. Generally speaking, no man is admitted to this division until he has held at least the post of deputy for a couple of years.

The school hours are, for the lower division, 20 per week in the first year, 24 per week in the second year, and, for the upper division,

36 hours per week; in the former division, 4 consecutive hours, and in the upper division 6 consecutive hours, are devoted to school work daily. The students in the lower division have to work their pit-shifts regularly whilst attending school; in order to render this possible, the students attend at the school either from 7 to 11 a. m. or from 3:30 to 7:30 p. m. The arrangement of the classes is worked out very systematically, and the curriculum is carefully tabulated, so as to facilitate the work as much as possible.

Although all instruction is gratuitous, those students who enter the upper division, and who must give their whole time to the school, have to keep themselves during the year. It is found that about one-half of the students do this entirely for themselves, having saved sufficient money for the purpose from their ordinary wages, while the other half are in receipt of pecuniary assistance from the collieries in whose employ they were, so as to enable them to qualify for managementships.

It appears that the companies exact no pledge from the men whom they thus assist that they will remain in their service when they have passed through the upper division. Further, it must be noted that there is no obligation whatever on any of the companies to employ as officials men who have passed through the mining school, but they find it so greatly to their advantage to do this that it is rare to find among the younger officials anyone not thus qualified. It must also be remembered that the appointment of colliery officials in Prussia is subject to confirmation by the mine inspectors, and these latter do not, as a rule, care to confirm the appointment of men who have not had the advantage of such a school training, this being further evidence that technically-trained officials are considered by those best qualified to judge as essential factors in the safe working of the collieries.

Closely connected with the school, and worked in conjunction with it and by its staff, are the testing and experimental stations of the Westphalian miners' fund. These comprise:

A laboratory in which about 4,000 analyses are made yearly for the various collieries, about two-thirds of which are analyses of mine gases and return air.

A rope-testing station, completely equipped with testing machines for torsion, bending, and tensile tests; that for the last-named purpose being a horizontal machine capable of exerting a pull up to 250 tons.

A fuel-testing plant for large-scale boiler tests of coal, briquettes, etc.

A plant for the mechanical testing of lubricating oils.

A plant for the calibration of anemometers.

All of the above are housed in the school building.

Further, the miners' fund maintains three observatories in the park at Bochum, which are under the charge of the chief instructor in surveying. These comprise a meteorological observatory, a seismological observatory and a magnetometric observatory.

The Fund also maintains the experimental gallery, which was, until quite recently, situated at the Consolidation Colliery, but which is this year being transferred to the Gneisenau Colliery, near Dortmund. Here explosives, fuses, and detonators are tested for their behavior in the presence of both coal-dust and fire-damp, and various electrical appliances are also tested; there is also a special chamber for the testing of safety lamps.

It is often urged that while such a school course may be good evidence of the technical knowledge of its students, it affords none as to their character, which is of at least as much importance as knowledge in colliery officials: but when it is borne in mind how much self-denial, energy, capacity for hard work, will power, and desire for improvement are required to enable a young man to go through the course of training above described, while at the same time doing his daily work in the pit, this objection appears to lose its force.

In addition to the list of subjects for instruction given above, there are voluntary classes for the teaching of diving, for which purpose there has been constructed at the school a pit of 20 m. ( $65\frac{1}{2}$  feet) in depth. About 75 per cent of the total number of students take the course in diving. There is also a gallery for practice with breathing appliances in irrespirable gases, this practice being obligatory on all students and forming a portion of the regular curriculum.

The school is completely equipped with the usual class rooms, preparation rooms, laboratories, etc.; there is also a fine library containing nearly 20,000 volumes, an admirably arranged and very complete museum of mining models and appliances, and a very complete geological collection, together with the well-known large model, showing the geological structure of the entire coal basin.

When it is remembered that the Westphalian coal field, despite its great natural disadvantages, such as difficult sinkings, steeply-inclined and heavily-faulted seams, coal of inferior quality, etc., has reached a pitch of technical and economic development that places it in the front rank of the world's greatest coal fields, and that its rate of growth has been one of extreme rapidity, with which none of our British coal fields can compare, it is well worth while to investigate every cause that can have contributed to this successful result; and it is sufficiently obvious that the scheme for the training of officials above described must be included among the contributory factors. This

scheme is no new thing, and has long ago passed beyond the experimental stage. It cannot be imagined that our German coal mining friends would have continued to maintain these institutions during nearly a century unless they found that it paid them to do so; for, be it again emphasized, they are in no sense supported or controlled by the State. They are maintained wholly and solely by the mining industry, which has it in its power to put an end to them as soon as it finds that they are not longer worth keeping up. Surely the successful experience of a century ought to count for something, and surely it is high time to abandon our insular policy of not profiting by the experience of our neighbors in matters of such vital importance to ourselves.

The writer is so firmly convinced that the best safeguard against colliery disasters lies in the better training of miners and mine officials, and in the higher degree of intelligence and more thorough state of discipline thereby produced, that he holds that the adoption of such a scheme is the very best possible means of insurance against accident that can be provided, and he urges this consideration most earnestly upon all concerned in or responsible for the prosperity and safety of mines and miners."

#### AUSTRIA.

##### *Secondary Mining Schools.\**

*By Herman Locker, Director of Mines, Brüx, Austria.*

All educational institutions for those connected with mines, owe their existence to the demand for mining engineers and foremen who have received a theoretical and practical mining education. The maintenance of schools for each of these classes is therefore assured only as long as there is such a demand and the same can be met.

The extent of the mining school education for officials and overseers will be determined by the local conditions and will depend on the difficulties and on the danger at the particular mine where men are to be employed; on the financial standing of the company; on the size of the mine; and on the advantages which will accrue to the company by the theoretical education of its officials and foremen. The course of instruction must be determined also by the preparatory education of the students, which often varies widely.

Great differences exist in the mining conditions in different states, and even between individual mining districts of a single state; these differences necessitate a difference in the degree and kind of mining education required for the officials and the overseers.

\*Originally published in *Mines and Minerals* for May, 1909, and taken from data furnished by Herr Löcker to the author of the present bulletin.

In Austria (not including Hungary), mining for ore and slate has been carried on since prehistoric times. Through the discovery of rich ore veins in countries outside of Europe, and through the continuous cheapening of freight rates, the Austrian mining industry, excepting for iron ores, has gradually decreased in importance, and mining is now confined only to the richest and most regular deposits.

Not until the beginning of the 19th century did coal mining become of importance in Austria. At first such mining was confined to coal at the surface, or at small depth below the surface, where it could be obtained cheaply and without danger. During this early time the demand for theoretically educated officials and foremen was very limited. The Mining Academy (college for mining and metallurgy) at Schemnitz, in Hungary, which was founded in 1764, and enlarged in 1770, furnished an ample number of mining engineers for Austria and Hungary. The foremen were instructed while at work by the engineers. Secondary mining schools were not in existence.

The rapid development in the industries, due to the extension in the use of the steam engine and to the development of railroads during the middle of the last century, required a great amount of iron and fuels. The production of iron ore and coal therefore increased rapidly. But while to a large extent the iron ore can be found even today outcropping and worked in open pits, the miner was soon compelled to follow the coal to a considerable depth below the surface. Difficulties and dangers increased with the depth both in number and degree. The surveying of mining shafts, and the necessity of using machinery on the surface and in the mine, placed higher demands upon the officials and overseers, and the need for a far-reaching theoretical education appeared.

In the year 1840, the "Institution for Mining and Metallurgy for Natives," was founded in Vordernberg, Styria, the object of which was at first the education of professional engineers for the iron industry. In 1849, this institution was changed to a government mining academy or college (*Bergakademie* or *Hochschule*), located at Leoben, and a similar college was founded in Pribram, in Bohemia.

The establishment of these academies was soon followed by the founding of secondary mining schools: 1851, at Pribram; 1869, at Leoben, Klagenfurt, and Dux; 1870, at Ostrau in Moravia, and afterwards at Wieliczka, at Dombrau, and finally at Boryslau.

Although Austrian coal mining was soon forced to follow the beds to some depth, it was possible to select from amongst the existing coal deposits those which offered the least difficulties and dangers, and to

first open and work them to exhaustion. However, by the second half of the last century the demand for coal and the increased prices due to the limited supply caused the development of mining under the most difficult and dangerous conditions.

The following will show the output of coal in Austria (not including Hungary) during the last 30 years, in metric tons:

<i>Year</i>	<i>Brown Coal, Tons</i>	<i>Mineral Coal, Metric Tons</i>	<i>Total, Tons</i>
1875 .....	6,851,266	4,549,624	11,400,890
1890 .....	15,329,057	8,931,065	24,260,122
1905 .....	24,167,714	13,473,307	37,641,021

If the Austrian coal mines are small as compared to those in Germany, England or the United States, they surpass them in most cases in difficulties and dangers. The mineral coal district of Karwin (Austria-Silesia) is the one in the world where firedamp occurs most often. The extensive brown-coal mines in Bohemia and Styria suffer most from spontaneous combustion, fires, and firedamp explosions. Quicksands and other dangers from water are found in the Bohemian soft-coal and in the Moravo-Silesian mineral-coal districts.

Under such conditions it was inevitable that mining catastrophes should appear in penetrating into the depth. We may here refer to the disastrous firedamp and coal-dust explosions in the hard-coal mining districts of Ostrau Karwin, to the floods and to the gas and firedamp explosions in the Bohemian soft-coal districts and to the catastrophe in the government ore mines, in Pribram. These were the cause of the enactments of the law of December, 1893, regarding the putting up of ladders and regarding the managing overseers in a mine. According to the regulations of this law a superintendent must be engaged for every independent mine, and the authorities must be notified that such a one has been engaged. He and the proprietor of the mine are held responsible for the observance of the laws and district ordinances. This superintendent must have graduated with credit from one of the mining high schools and must have been actively engaged for at least 3 years in the practical working of a similar mine. The government only makes exception to this rule when small and less dangerous mines are in question. Besides this the mine owner is obliged to assign to the manager several overseers, or foremen, who have graduated at a secondary mining school or whose practical abilities for the tasks assigned to them have been proven.

The technical staff of an Austrian mine, on account of this law, is ordinarily divided into three groups, according to technical preparation required:

1. The mining schools furnish the superintendents and their assistants, the surveyors, and the leading officials of the more extensive mining enterprises.

2. The secondary mining schools furnish the operating or active mining supervisors (master miners, bosses, and assistant bosses), also the assistant surveyors and superintendents for smaller mines. Graduates of secondary mining schools, who are especially intelligent, can even advance to the position of manager or superintendent, just like the graduates of the high schools. But since the above-mentioned law has been in force this advancement has become very difficult.

3. Intelligent, experienced, and reliable miners (ordinary miners, chamber workers, etc.), who are able to read and write, are promoted to such lower official positions as master miners, foremen, blasters, fire bosses, etc., and they are entrusted with the supervision of the workmen, with the blasting and controlling of the firedamp conditions or similar duties in limited parts of a mine. Through practical experience, especial intelligence, and home study, a part of these lowest mining bosses have succeeded in advancing into the class of higher officials.

The secondary mining schools of Austria, therefore, correspond to the German government mining schools. They were brought into existence through the urgent needs of the different districts in Austria and are therefore usually situated in the mining centers. Of the eight secondary mining schools in Austria, seven were founded and are maintained by the united mining companies of the respective districts in which they are located, the government simply subsidizing them; the eighth, in Pribram, is a government school, but only because it is situated in a region where there are extensive government ore mines, for which it furnishes the officials. The mining schools are therefore kept up by the mining companies in order to educate the officials that they need, and the plan of study is adapted to this specific object.

In the mining schools in the center of the coal districts (Dux, Moravian-Ostrau, Dombräu) those sciences are taught which are necessary for coal mining as a whole and for that of the special district in particular; in Boryslau (Galicia) they teach mostly matters pertaining to the boring of petroleum wells; in Wieliczka to the mining of rock salt; in Pribram to the mining of ore. For schools like those in Leoben and Klagenfurt in whose support companies mining coal, ore, and salt are interested, a more general course of instruction is adopted.

These mining schools admit men who have worked in the mines at least 3 years, 1 year of which must be as a miner; they must be healthy, more than 18 years old and be able to read and write fluently and

know arithmetic well enough to do calculations in the four principal figurings with whole numbers.

The instruction is given in two courses; each of 1 year's duration, a preparatory, and a professional course.

In the mining schools of the Alpine districts (Leoben and Klagenfurt), which are not situated directly in the mining regions, instruction is given during the whole day; in the other schools instruction is given during half a day only, and the students are required, in order to increase their experience and to earn their living, to work in the mines for the rest of the day.

In most cases these mining students receive aid from their employers, which enables them to attend the school without any sacrifices; but for this they are bound by contract to remain a certain time (say 3 years) after they have graduated from the mining school, or else to repay the company what is spent for their aid. Students who work for a company that subsidizes a school, receive the tuition free. On the other hand workmen who work in other mines pay a tuition fee of from 40 to 100 Kronen (from \$8 to \$20) a year.

The following subjects of instruction and the number of hours devoted to each are given for an institution teaching a full day and for one teaching only half a day:

#### MINING SCHOOLS—PREPARATORY COURSE, 1 YEAR

	<i>Klagenfurt:</i> <i>Instruction the whole day</i>	<i>Dux:</i> <i>Instruction a half day</i>
	10 months' session	10 months' session
Arithmetic, algebra, and geometry..	260 hours	210 hours
Physics, natural philosophy.....	144 hours	79 hours
Instruction in machinery.....	80 hours	
Mineralogy .....	86 hours	54 hours
Geology .....	70 hours	75 hours
Chemistry .....	130 hours	
Composition .....	112 hours	91 hours
Caligraphy .....	112 hours	29 hours
Drawing .....	282 hours	158 hours
	<hr/> 1,276	<hr/> 696

#### PROFESSIONAL COURSE, SECOND YEAR

Science of mining.....	184 hours	222 hours
Surveying .....	174 hours	114 hours
Mining machines.....	150 hours	146 hours
Mining law .....	78 hours	32 hours
Bookkeeping for mine.....	28 hours	
Drawing .....	260 hours	158 hours
Composition .....	123 hours	
Caligraphy .....	81 hours	
First aid .....	30 hours	24 hours
	<hr/> 1,108	<hr/> 696

The theoretical instruction is connected, if possible, with practical work, especially in attending to machines and boilers, in surveying, and in first aid; besides this, excursions to neighboring mines are made for the sake of instruction.

These mining schools bring forth an excellent staff of officials, and give the foundation upon which ambitious persons can get the education required if they want to advance to official positions.

The aid which is given by the mining companies (in their own interest), to the mining school and to the students, makes it possible in Austria for the poorest workman to receive an education in mining. This is the reason why it is unnecessary to maintain night schools and lectures.

#### ITALY.

According to Mr. Sexton Italy maintains two schools for the education of mine foremen, one at Iglesias in Sardinia and one at Caltanissetta in Sicily. The matriculant must have a good secondary education and spend nearly full time in attendance for three years.

#### HUNGARY.

Hungary maintains four mining schools, one having a six-year course of twenty to thirty hours per week throughout the year, and the other three having a four-year course of eighteen hours per week.

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